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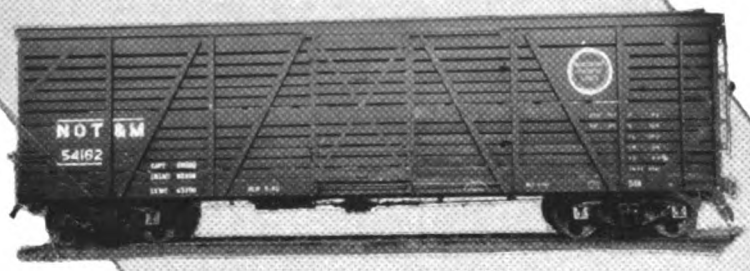
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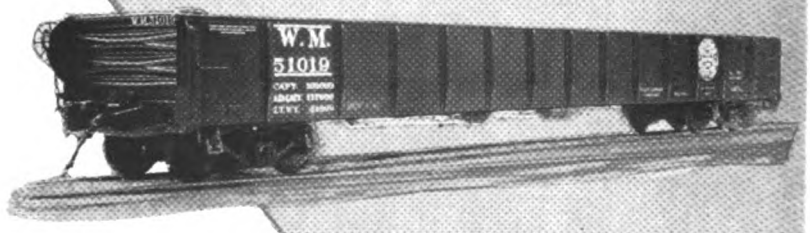
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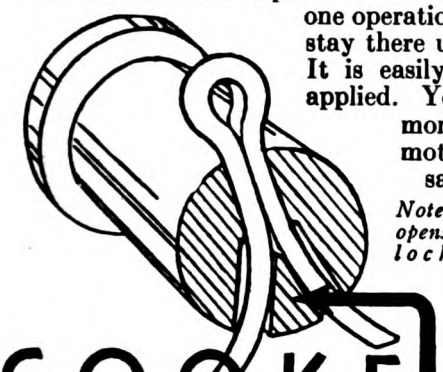
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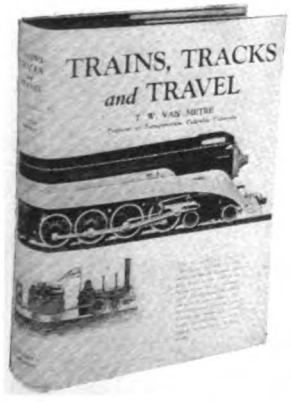
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THE EDITOR'S DESK

ALL RECORDS SMASHED! BUT WHAT LIES AHEAD?

The year 1942 promises to stand out in prominent relief in American railway history for a long time. After years of depression, but with a good running start prior to Pearl Harbor, the railways in 1942 smashed all records in both freight and passenger traffic.

As Dr. Julius H. Parmelee, director of the Bureau of Railway Economics, A.A.R., points out in an annual review article in the Railway Age, the freight train load in 1942 increased to 1,030 net tons, and the passenger train occupancy to 115. Expressed in another way by President J. J. Pelley of the A.A.R., the volume of freight traffic handled was 33 per cent greater than in 1941, the previous record year; and passenger traffic was 13 per cent greater than that of 1920, which marked the previous high spot. Record levels were also achieved in ton-miles per freight-train hour, average car load, car-miles per freight-car day, and the daily mileage run by both freight and passenger locomotives.

In spite of general recognition of the fact that the railroads are essential to the successful prosecution of the war, the authorities at Washington have felt that materials and equipment required by the railroads were of secondary importance to the building and supplying of ships and munitions.

By superhuman efforts the railroad managements and workers, handicapped as to materials, equipment and manpower, have thus far successfully met the demands made upon them. Whether they can continue to do so is a question which involves a number of indeterminate factors. For one thing, no one can predict with any certainty, not even those in the inner councils, what major shifts may have to be made in our production processes as the fortunes of war sway back and forth and new and baffling challenges develop.

Certainly no effort must be spared by the railroads to continue to make the best possible use of every man-hour and every ounce of material available. Let us hope, also, that the War Production Board will find ways and means of giving the railroads a better break in releasing much needed materials and equipment to them. That Board took a long gamble last year and won out because of the spectacular speeding up of efficiency in railroad operation and in maintenance of the facilities and equipment in prime condition. There are limits, however, beyond which it will be impossible to go, in spite of the best of intentions and Yankee ingenuity.

Here's hoping for the best in the months to come!

Roy V. Wright

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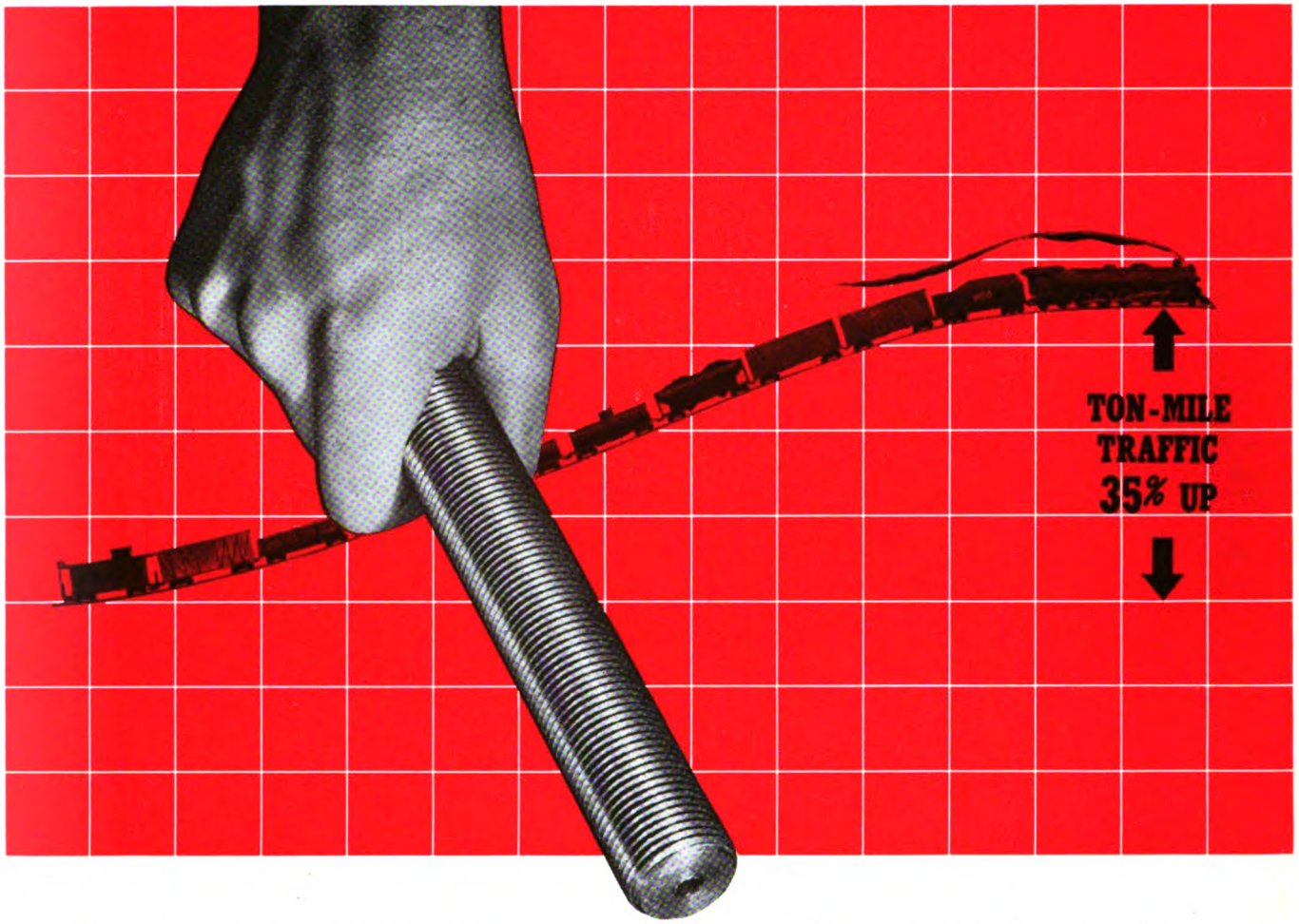
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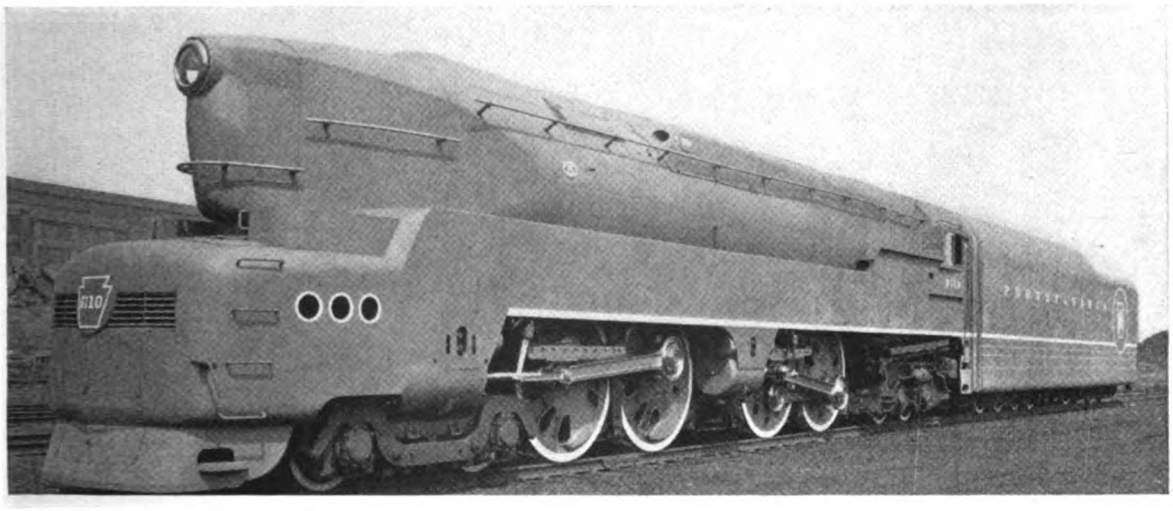
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Pennsylvania T-1 Locomotives

Non-articulated 4-4-4-4 type passenger locomotives are designed to handle a trailing load of 880 tons at a speed of 100 m.p.h. on level, tangent track—Steam distribution system utilizes poppet valves.

ABOUT four years ago the Pennsylvania, in collaboration with the builder's engineering staff, initiated development work on a steam locomotive possessing operating characteristics comparable with the Pennsylvania Class GG-1 electric locomotives. Early in 1942 two high-speed passenger locomotives of the 4-4-4-4 type went into service. These two locomotives built by The Baldwin Locomotive Works, known as the T-1 class and bearing road numbers 6110-6111 are now being used in mainline service between Harrisburg, Pa., and Chicago. They are designed to cover this territory with only one stop for fuel and to have capacity to handle an 880-ton trailing load on level tangent track at 100 m. p. h.

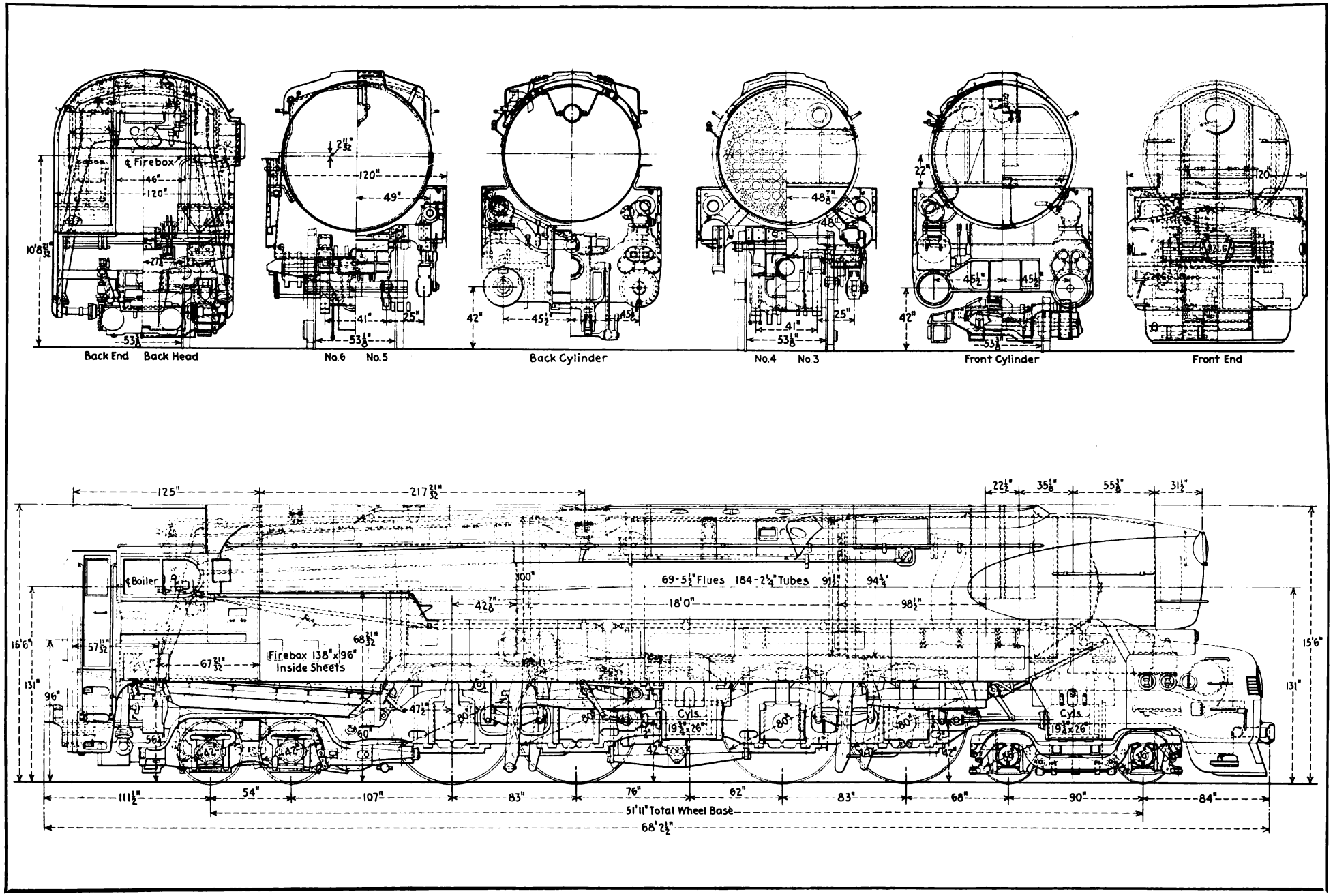
The T-1 Class has the general characteristics of the 6-4-4-6 locomotive exhibited at the New York World's Fair, with the important advantage that they can be operated in any main-line territory of the Pennsylvania. The order for these locomotives was placed in July, 1940, and they were completed in April and May, 1942. The tractive force of the locomotives is 65,000 lb. plus 13,500 lb. for the booster with which one of the two units is equipped. They have a driving-wheel base of 25 ft. 4 in. and a total engine and tender wheel base of 107 ft. 0 in.

These locomotives have a nominal capacity equivalent to a 4-8-4 but the 4-4-4-4 wheel arrangement permits the use of small cylinders with reduced piston loads, lighter machinery parts and lower piston speed. While the wheel base is long, lateral motion devices on the first and third drivers permit 15-deg. curves to be traversed.

Outstanding features of the design are the steam distribution system using poppet valves and the development of a clasp brake on the drivers and the trailer truck which embrace the use of flangeless brake shoes and which results in the elimination of hitherto objectionable unbalanced forces. Coincident with the demand for high capacity for long-run operation within definite wheel-base limits is the necessity for weight reduction in running-gear parts which has been solved by the use of alloy steel of special characteristics.

Steam Distribution System

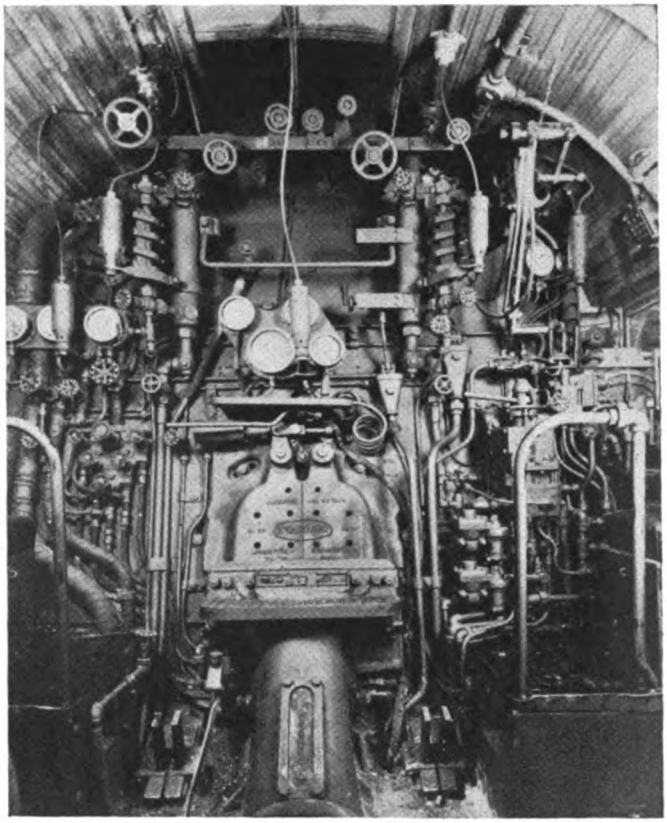
The Franklin system of steam distribution, applied to these locomotives, consists of four major units. These are the cylinders and related parts, the cam boxes, the gear boxes—one for each engine—and the power reverse gear. Except for the peculiar problems of application with respect to these four-cylinder locomotives, the equipment is like that used on Pennsylvania locomotive No.



Elevation and cross-sections of the Pennsylvania 4-4-4-4 type locomotive

General Dimensions and Weights of the Pennsylvania T-1 Class Locomotives

Builder	Baldwin Locomotive Works	
Type of locomotive	4-4-4-4	
Road class	T-1	
Road numbers	6110-6111	
Date Built	May, 1942	
Service	Passenger	
Dimensions:		
Height to top of stack, ft.-in.	15— 6	
Height to center of boiler, ft.-in.	10—11	
Width overall, in.	10— 7	
Cylinder centers, in.	91	
Weights in working order, lb.:	(without booster)	(with booster)
On drivers	268,200	267,840
On front truck	100,200	102,360
On trailing truck	128,800	138,200
Total engine	497,200	508,400
Tender (fully loaded)	433,000	433,000
Wheel bases, ft.-in.:		
Driving	25— 4	
Rigid	18— 5	
Engine, total	51—11	
Engine and tender, total	107— 0	
Wheels, diameter outside tires, in.:		
Driving	80	
Front truck	36	
Trailing truck	42	
Engine:		
Cylinders, number, diameter and stroke, in.	4—19¾ x 26	
Valve gear, type	Franklin	
Valves, poppet:		
Intake, number and diameter, in.	16— 5	
Exhaust, number and diameter, in.	16— 6	
Maximum lift, intake, in.	1	
Maximum lift, exhaust, in.	¾	
Cut-off in full gear, per cent	75	
Boiler:		
Type	Modified Belpaire	
Steam pressure, lb. per sq. in.	300	
Diameter, first ring, inside, in.	89¾	
Firebox length, in.	138	
Firebox width, in.	96	
Height, mud ring to crown sheet, back, in.	70	
Height, mud ring to crown sheet, front, in.	87	
Combustion chamber length, in.	96	
Circulators, number	5	
Tubes, number and diameter, in.	184— 2¼	
Flues, number and diameter, in.	69— 5½	
Length over tube sheets, ft.-in.	18— 0	
Net gas area through tubes and flues, sq. ft.	9.55	
Fuel	Bituminous coal	
Grate area, sq. ft.	92	
Heating surfaces, sq. ft.:		
Firebox and comb. chamber	419	
Arch tubes	None	
Circulators	80	
Firebox, total	499	
Tubes and flues	3,719	
Evaporators, total	4,218	
Superheating	1,680	
Combined evap. and superheat	5,898	
Tender:		
Style	Rectangular U	
Water capacity, U. S. gal.	19,500	
Fuel capacity, tons	41	
Trucks	eight-wheel	
General data, estimated:		
Rated tractive force, engine 85 per cent, lb.	65,000	
Rated tractive force, booster, lb.	13,500	
Total rated tractive force, lb.	78,500	
Speed at 1,000 ft. per min., piston speed, m.p.h.	55.0	
Piston speed at 10 m.p.h., ft. per min.	182.1	
R.p.m. at 10 m.p.h.	42.0	
Weight proportions:		
Weight on drivers + weight engine, per cent	54.0	
Weight on drivers + tractive force	4.13	
Weight of engine + evaporation	118.2	
Weight of engine + comb. heat. surface	84.4	
Boiler proportions:		
Firebox heat. surface per cent comb. heat. surface	8.4	
Tube-flue heat. surface per cent comb. heat. surface	63.0	
Superheater heating surface per cent comb. heat. surface	28.5	
Firebox heat. surface + grate area	5.43	
Tube-flue heat. surface + grate area	40.42	
Superheater heating surface + grate area	18.3	
Comb. heat. surface + grate area	64.0	
Gas area, tubes-flues + grate area	0.14	
Evaporative heating surface + grate area	45.8	
Tractive force + grate area	703.0	
Tractive force + evaporative heat. surface	15.4	
Tractive force — comb. heat. surface	11.00	
Tractive force x diameter drivers + comb. heat. surface	878.0	



The controls in the cab are conveniently arranged

5399 which was described in detail in previous articles.*

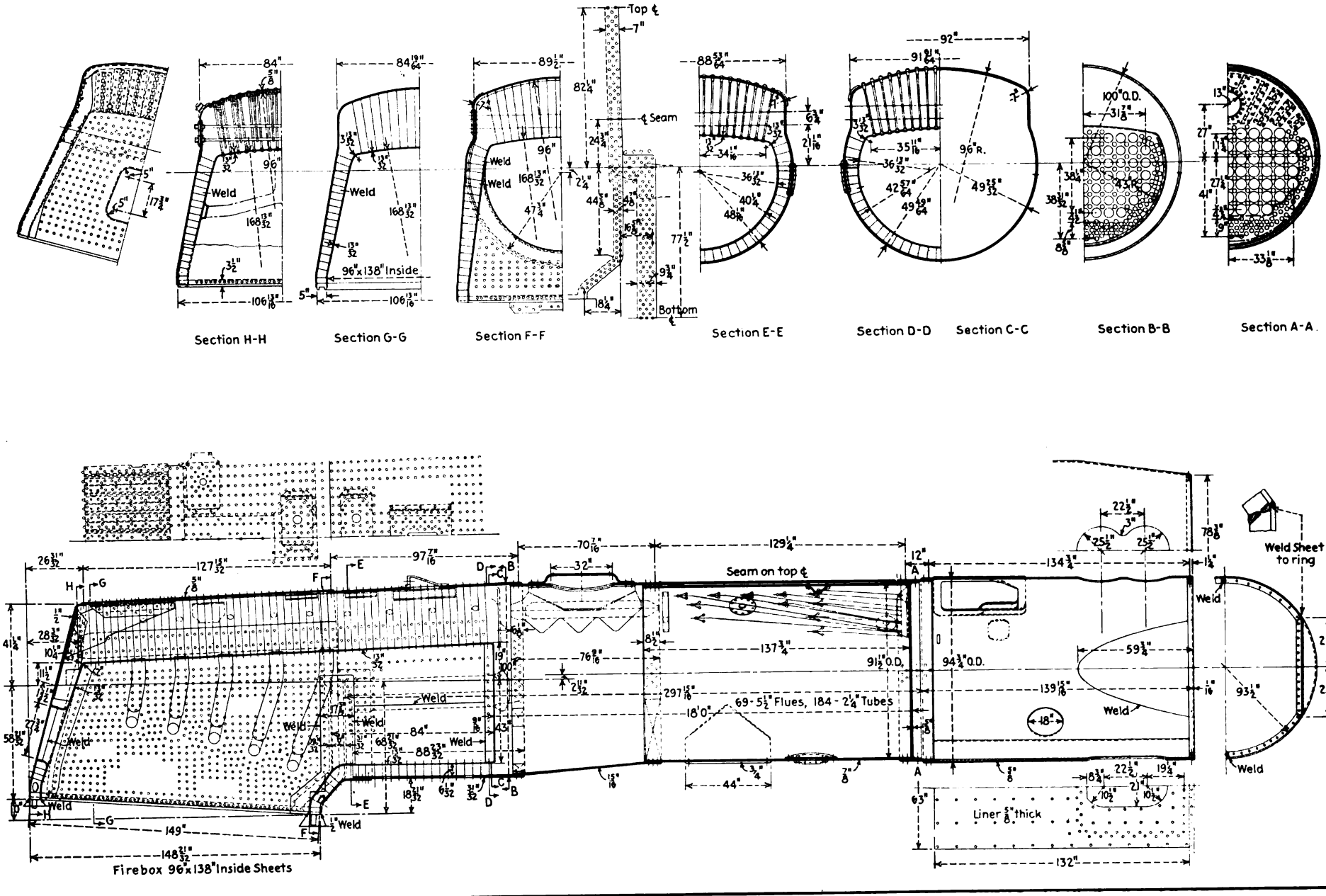
Each of the four cylinders has a steam chest at each end of the barrel and each steam chest contains two inlet and two exhaust valves of the horizontal double seated type. The exhaust valves are located nearest the cylinder barrel.

The eight valves of each cylinder are operated through a cam box located in the space between the steam chests. Each cam box contains two cam shafts, each of which carries two identical cams. Intermediate levers in the cam box with rollers bearing against opposite sides of these cams, actuate front and back pairs of inlet and exhaust valves. The cam shafts receive their motion through cranks and connecting rods from gear boxes which are located on the center line of the locomotive.

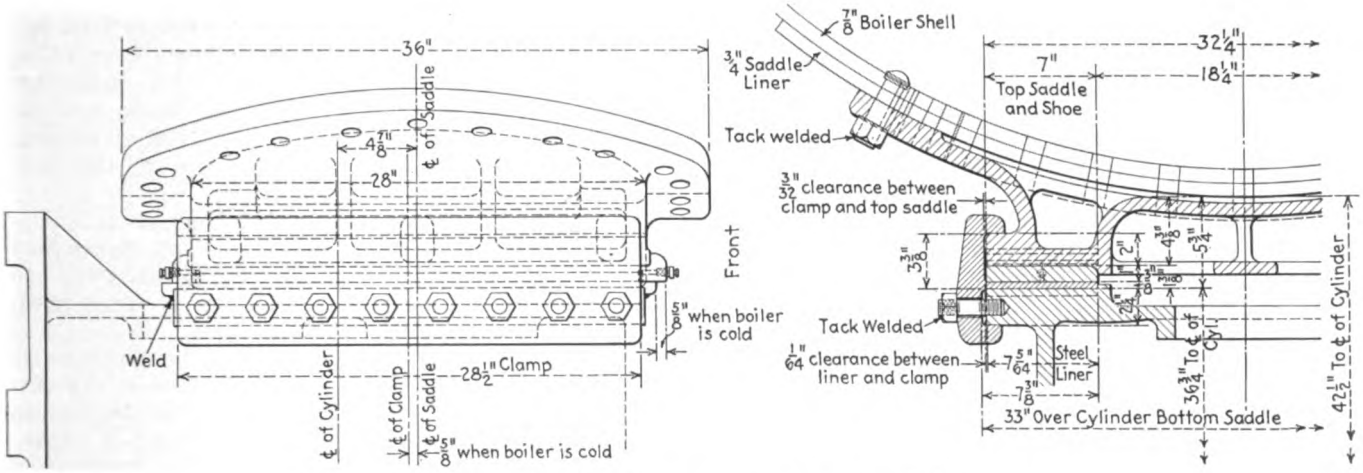
The gear box contains the valve motion and reverse mechanism consisting of four independent link motions, one intake and one exhaust motion for each side of the engine. The principle of the valve motion is similar to that of a Walschaert gear except that the lnks are not driven from an eccentric crank but from the crosshead of the opposite side. This motion is imparted by a connection to the engine crosshead from each side of the gear box. The links are inside the gear box and the link "blocks" (rollers in this case) are moved in the slot through a mechanism controlled by the power reverse gear.

The reversing mechanism requires but little power. Furthermore, all reactions from the link blocks are ab-

* For a description of the O. C. poppet valve gear and its development see the *Railway Mechanical Engineer* for September, 1939, page 349. For the road tests of the poppet valve installation on Pennsylvania locomotive 5399 see the article in the *Railway Mechanical Engineer* of April, 1941, page 125, entitled "Poppet Valves Tested on the Pennsylvania Railroad." For a description of the changes in the locomotive and the subsequent tests on the Altoona test plant, see the article in the *Railway Mechanical Engineer* of May, 1941, page 169, entitled "Poppet Valves Tested at Altoona."



The boiler of the Pennsylvania Class T-1 locomotive



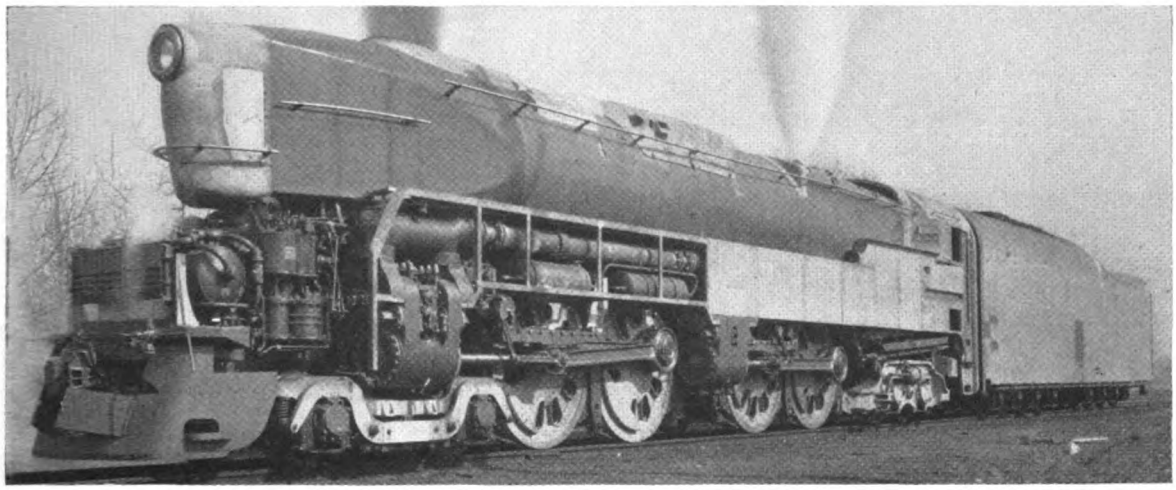
Details of the sliding boiler support at rear engine cylinders

sorbed by reach-rod screws located within the gear box. Therefore, power is needed only for reversing, and not for holding the gear in a certain cut-off.

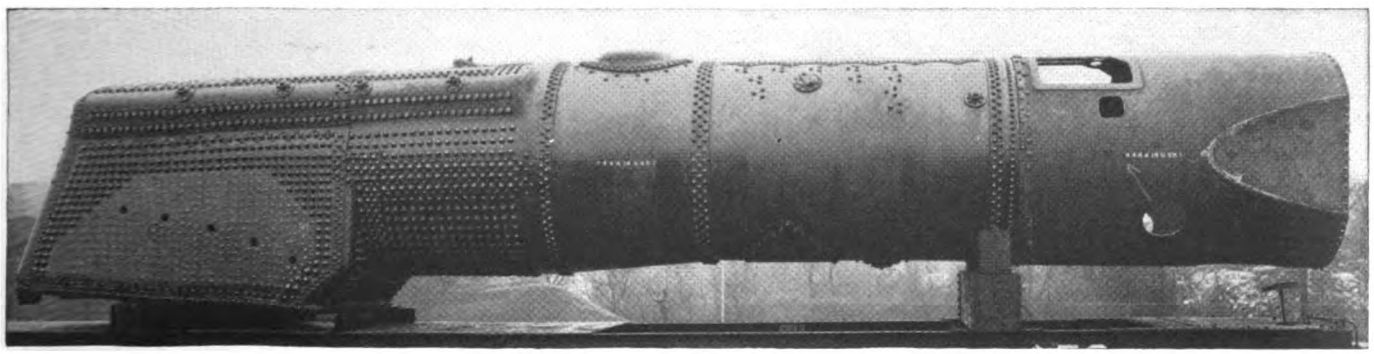
In view of these facts, and to comply with the law, a small power reverse gear has been designed to operate the operating mechanism. This reverse gear is located entirely within the cab and is connected to the gear box by rotating connecting shafts equipped with universal joints. Expansion joints incorporated in the universal joints allow the shafts to expand or to contract in length.

The power reverse gear is operated by a small air motor controlled by a valve and hand lever. An indicator shows the cut-off positions for forward and backward gear. The air motor is equipped with a bevel gear driving another bevel gear keyed to the reversing screw shaft. At the front the screw shaft connects to the reverse connecting shaft leading to the gear box through bevel gears and universal joints.

The above is a general description of the several units of the steam distribution system. On these locomotives the application of the several units involved some interesting problems brought about by clearance limitations within the running gear. The gear boxes, located on the center line of the engine, are located directly ahead



Locomotive, with part of sheathing removed while undergoing tests, showing arrangement of cylinders, steam pipes, air compressors and air reservoir



The boiler has a modified Belpaire type firebox

of or behind the cylinder. In the case of the front engine the gear box is mounted, in a horizontal position, ahead of the front cylinders. The motion of each engine crosshead—right and left side—is imparted to a transverse shaft by links and lever arms and, in turn, to the cranks on the gear box by other connecting rods. The screw shaft of the gear box receives the rotary motion from the reverse gear shaft through a connection at the rear end of the gear box.

The gear box for the rear engine is identical in design to that of the front engine gear box but is mounted vertically against the back surface of the rear engine cylinders. The driving mechanism from engine crosshead to gear box is similar in principle though different in arrangement due to location problems. The screw shaft of this gear box is connected to the rotating shaft from the power reverse gear at the top of the box.

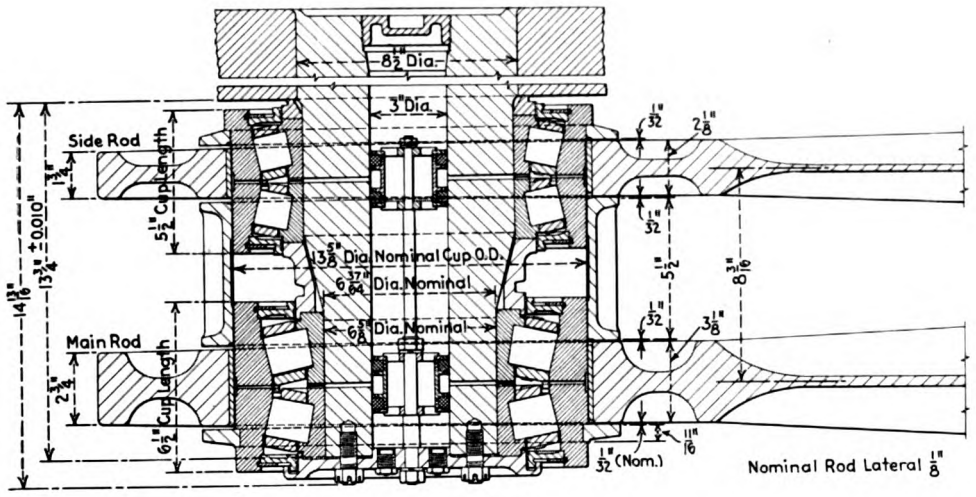
The Boiler and Appurtenances

The boiler is the straight top type with a modified Belpaire firebox. The overall length is 50 ft. $1\frac{1}{16}$ in. and the maximum width over firebox sheet is 9 ft. $\frac{1}{16}$ in. The width at the top of the firebox tapers from 84 in. at the back to 92 in. at the front, over the combustion chamber. The first course is $89\frac{3}{4}$ in. inside and the second course increases from $91\frac{1}{2}$ in. to 100 in. outside.

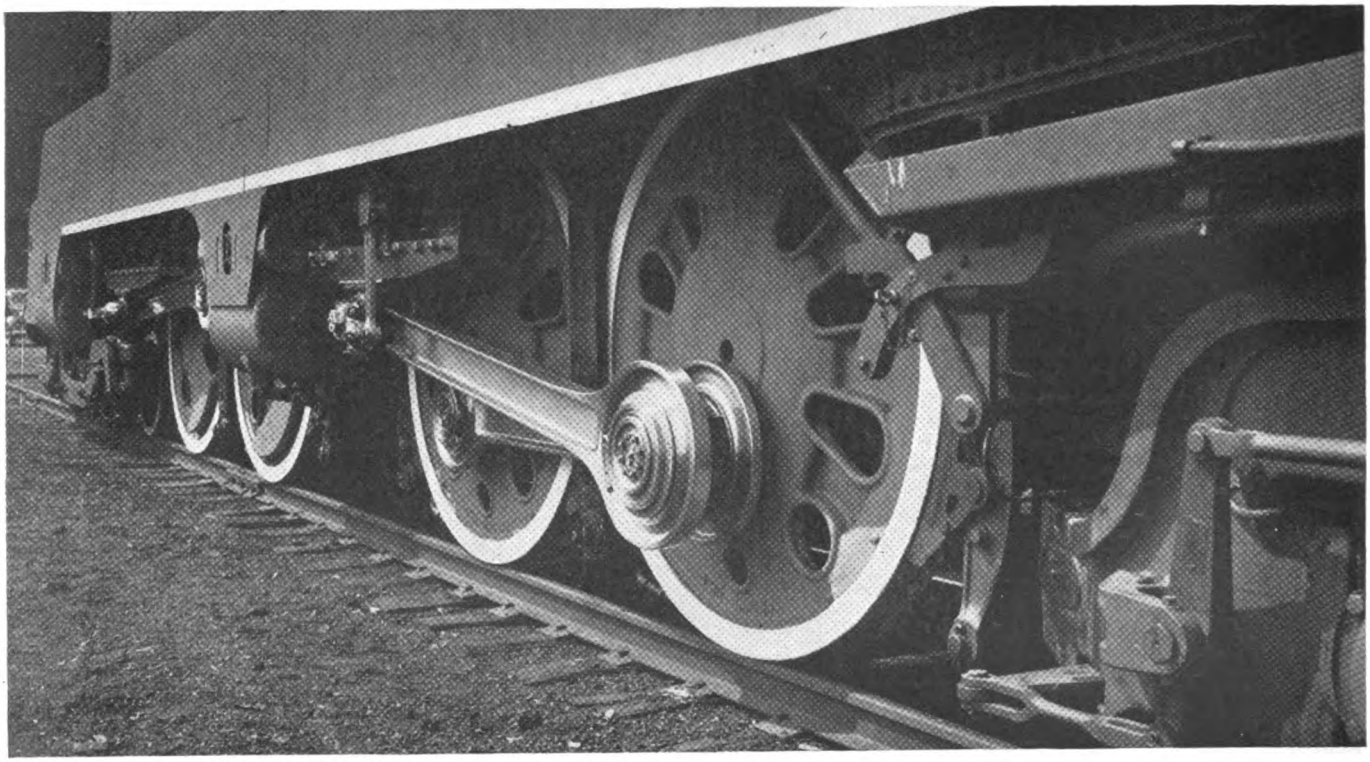
The firebox is 138 in. long, 96 in. wide and the combustion chamber is 96 in. long.

The shell-course sheets are $\frac{7}{8}$ in., $\frac{15}{16}$ in. and $\frac{31}{32}$ in., and the firebox and combustion chamber sheets vary in thickness from $\frac{13}{32}$ in. to $\frac{19}{32}$ in. Nickel steel was used for the shell, welt strips, top wrappers, back head, dome and front tube sheets.

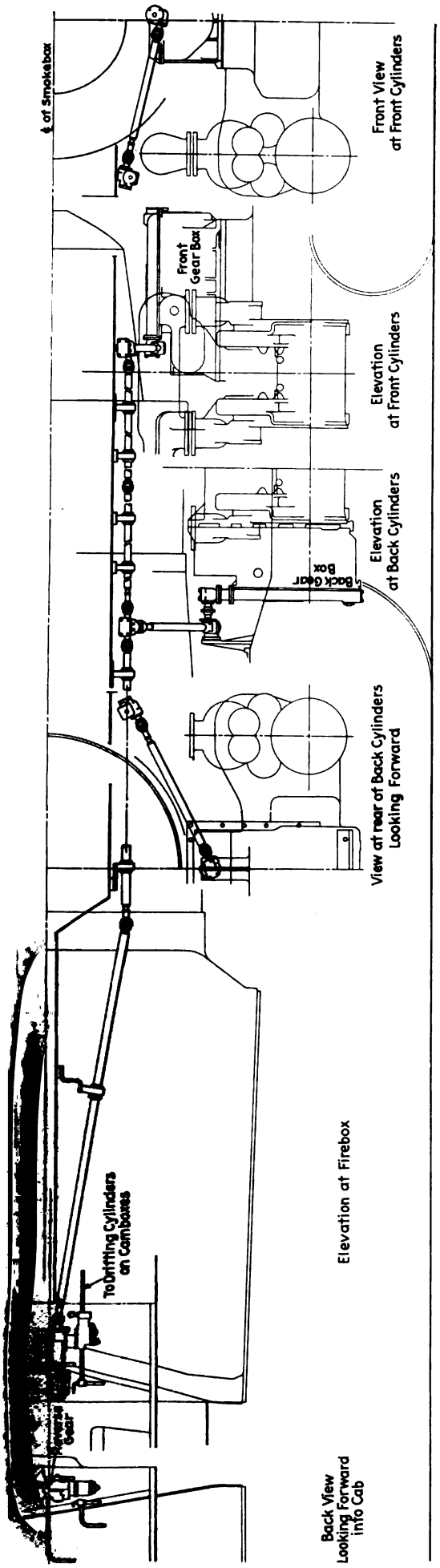
Flexible staybolts are applied in the breaking zones of the firebox in two boundary rows of the side sheets and back head, in the throat sheet, and in the combustion chamber below the crown sheet. Four rows of expansion stays are used at the front of the combustion chamber. Rigid water-space stays and transverse stays for the Belpaire firebox complete the installation.



At the main crank pin separate bearings are used for the main and side rods. The rods may be removed without disturbing the bearing assembly



The running gear, showing roller-bearing rods and crossheads



Control mechanism for valve gear is designed with bevel gears, universal joints and expansion joints

The construction of the boiler involved the use of welding in several places. The firebox and wrapper sheets are riveted and welded to the mud ring; the wrapper is seal welded to the back head; the door sheet is welded to the firebox side sheets and the crown is welded to the side sheets.

The firebox has five seamless-steel circulators supporting a brick arch. The vertical legs of the circulators enter the crown on the center line of the boiler and the horizontal legs enter the side sheets in locations sloping from back to front. The superheater is the Type AS with 138 units of the sine-wave type. Water is fed by means of a Sellers Type E injector on the left side and a Hancock Type 7-A-2 turbo feedwater heater on the right side, each of 13,000 gal. per hour capacity. The railroad company's standard grates, with 15 per cent air openings, are used and coal is fed by a Standard HT stoker.

While this locomotive consists of front and rear engines, it is not of the articulated type. This simplifies the steam and exhaust piping to the extent of eliminating ball joints. The steam pipes are designed to be free of restriction as to capacity. The dry pipe to the header is 10½ in. diameter inside with 9½ in. pipes inside the smokebox from the multiple throttle to a tee in each of the outside steam pipes, which are 7 in. These pipes, located longitudinally underneath the boiler, connects the manifolds at the cylinders, which serve the steam chests containing the poppet valves. Expansion joints are located in the pipes between the manifolds. The exhaust from the front cylinders passes through ports in the saddle to the front part of the double exhaust nozzle and companion ports in the front cylinder saddle receive the exhaust steam from a central exhaust line from the rear cylinders and transmit it to the rear exhaust nozzle. From there the steam passes out through a double stack with two 19-in. openings. The stack is welded to the smokebox. The feedwater heater takes exhaust steam from the rear engine unit.

The front end arrangement is of Pennsylvania standard design and is similar to that of the Class S1 locomotive No. 6100.

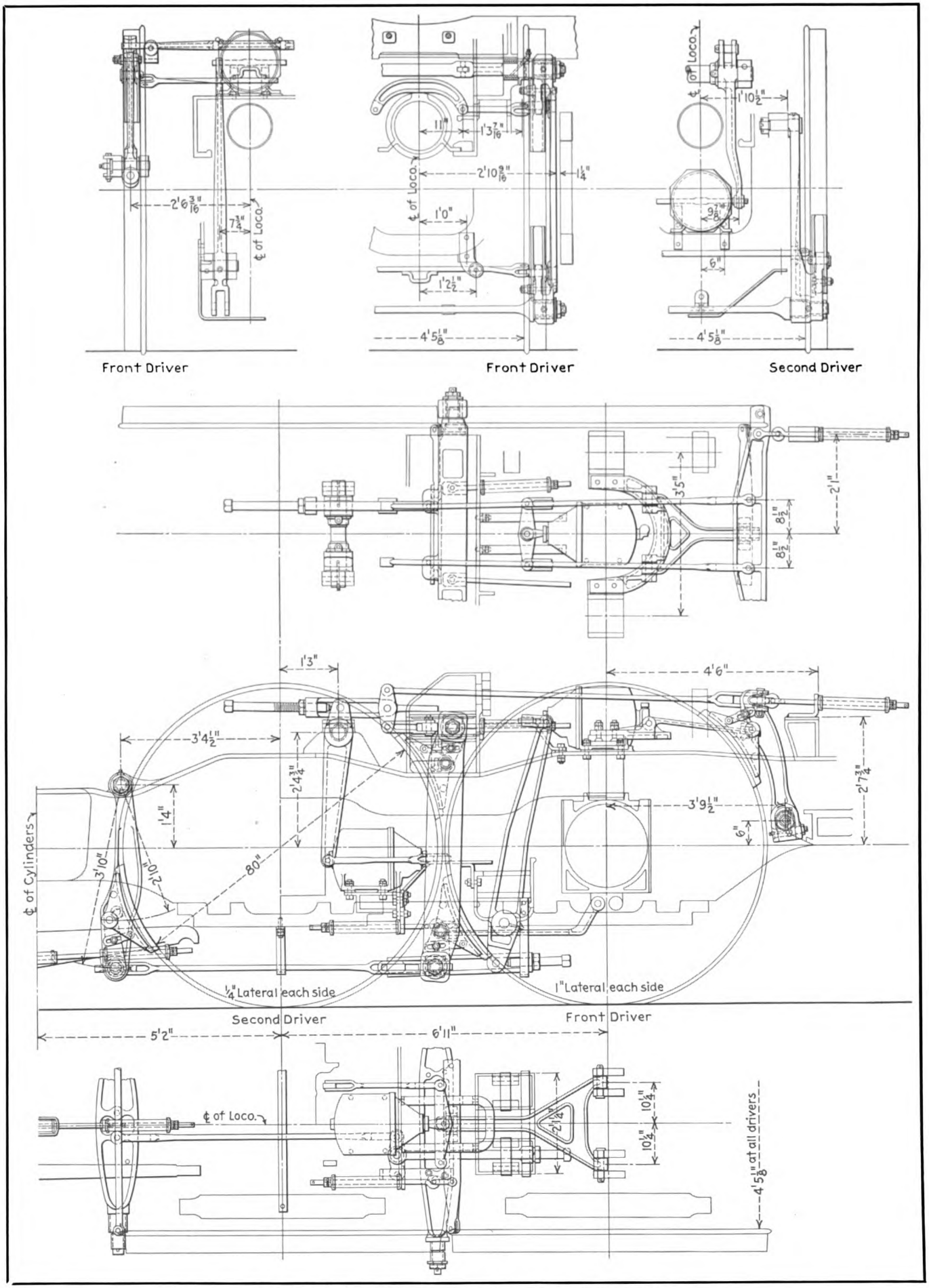
The Running Gear

The engine bed is a steel casting supplied by General Steel Castings Corporation which embraces the four cylinders, back heads, cross members, spring equalizer supports, brake-hanger brackets and various other attachments, all cast integral. The leading and trailing truck frames are also steel castings. The boiler is rigidly secured to the front cylinder saddle. At the rear cylinders and at the firebox lubricated sliding shoes take care of expansion and contraction.

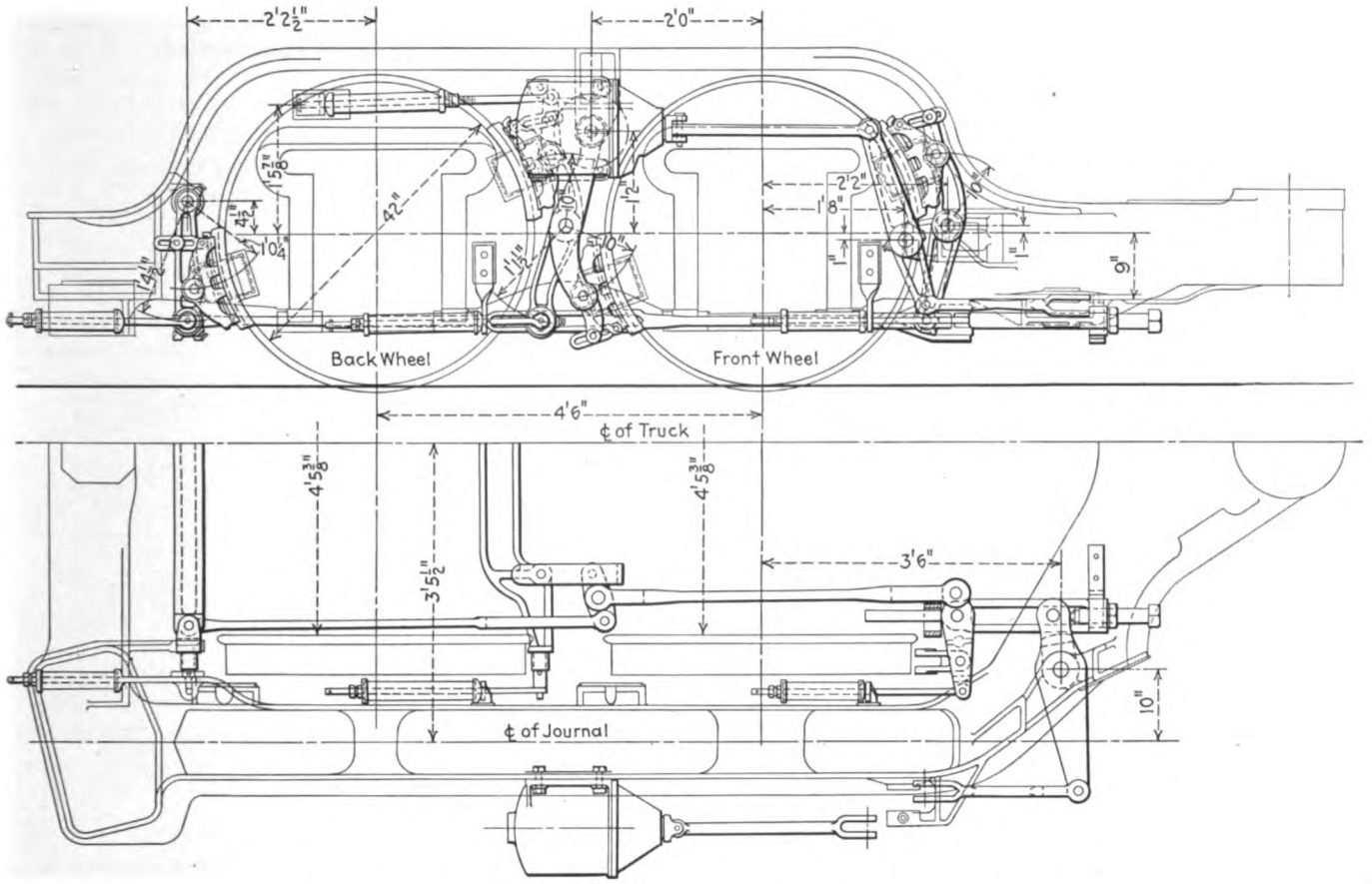
The driving wheels are the Baldwin disc type with flanged tires on all drivers. The Alco lateral motion device, allowing 2 in. total lateral play is used on the first and third pairs of drivers. The resistance against lateral movement at No. 1 wheel is 17 per cent and at No. 3 wheel 10 per cent. The wheels are mounted on open-hearth carbon-steel axles, hollow bored. Timken roller bearings are used on all engine and trailing truck and driving wheels.

The driving axles measure 11½ in. in diameter at the roller seat.

The spring rigging is a continuous equalization system for each side of the locomotive from No. 1 driver through the trailer truck. The spring hangers have ball seats on the end clips and roller pins at the lower ends. A coil spring snubber is used back of the rear trailer wheels.



The driver brake arrangement involved some new design problems



This design of trailing truck brake made possible a reduction in wheel center distance

In the design of the revolving and reciprocating parts weight reduction was a major consideration. To this end the pistons, crosshead forgings and the main and side rods are of Timken light-weight design and high-dynamic steel. Timken roller bearings are also installed on the crank pins and crosshead pins. The piston rods are hollow-forged, 4½ in. diameter. The crossheads are the Pennsylvania underhung design operating in multiple-ledge guides. The crank pins are Timken steel with hollow bored main pins. The left-hand cranks lead, in accordance with Pennsylvania practice.

Some indication of the influence of the small cylinder size on the design of reciprocating parts may be seen in the fact that these parts weigh only 1,992 lb. for one side of the locomotive—1,041 lb. for the front unit and 951 lb. for the rear unit. The weight difference between the front and back units is accounted for principally by a difference in piston-rod length.

The main crank-pin arrangement is the first roller-bearing application made to a four-coupled engine. This application differs from previous crank-pin applications in that separate bearings are used under the main and side rods. The main crack pin assembly is so designed that the rods may be removed without disturbing the assembly of the bearings on the crank pins. All enclosures on both main and front crank-pin assemblies are held in place by means of snap rings, thereby eliminating the use of cap screws or bolts. Both main and side rods are mounted on the bearing cups, or outer races and the lateral rod clearance totaling ⅛ in., together with the normal clearance between rod bores and bearing cups, allows for adjustment to the 2-in. total lateral of the first and third drivers. The lateral at the second and fourth drivers is ¼ in. in each direction, or a total of ½ in.

The arrangement of the driving-wheel roller bearings involves the use of a single row of rollers at each end of the housing. Special lugs are cast on the bottom of these housings to keep the movement of the braking parts in proper relation to the lateral movement of the wheels and axles.

The frame shoes on the driver application are the bronze insert type by means of which the fore and aft clearance of the housing within the pedestals may be adjusted by shimming.

The leading engine truck is the constant-resistance type with outside journals and roller bearings and the trailing truck is the Delta type, also equipped with roller bearings. Both trucks have heat-treated rolled-steel wheels 36 in. diameter on the front truck and 42 in. on the rear truck.

An interesting feature of the trailer truck is the reduction of 10 in. in wheel centers as a result of the clasp-brake arrangement described elsewhere. This, together with alloy castings permitting thinner sections, resulted in a truck weighing only 30,784 lb. Both trucks were furnished by General Steel Castings Corporation. The Franklin booster is applied to the rear truck of one locomotive and the other locomotive is designed for such application.

Brake Equipment

In the design of the foundation brake rigging for this locomotive, it was necessary to use clasp-brake rigging on all units in order to avoid excessive brake-shoe pressures per square inch of shoe surface.

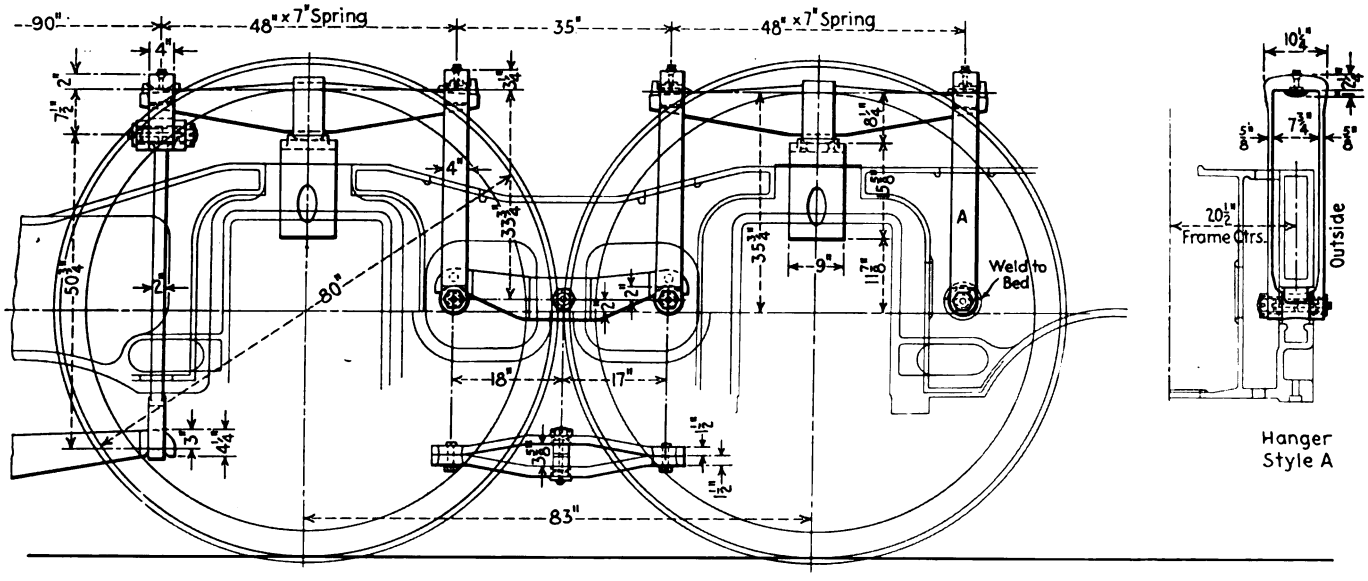
On the engine truck this was a comparatively simple matter, as a conventional type of clasp brake was readily applicable. In the case of the driver brake, however, so

Partial List of Material and Equipment on the Pennsylvania T-1 Class Locomotive

Locomotive bed with cylinders; engine and trailer trucks; trailer-truck centering device	General Steel Castings Corp., Eddystone, Pa.
Engine-truck and trailer-truck wheels; driving tires; trailer springs (one engine); trailer truck springs; driving-wheel centers	Standard Steel Works Division of the Baldwin Locomotive Works, Eddystone, Pa.
Driving-box roller bearings; engine and trailer-box roller bearings	The Timken Roller Bearing Co., Canton, Ohio.
Springs—driving and engine truck	American Locomotive Co., Railway Steel Spring Div., New York.
Brake shoes	American Brake Shoe & Foundry Co., New York.
Driver and truck brake; locomotive and tender brake equipment	American Brake Div., Westinghouse Air Brake Co., Wilmerding, Pa.
Train-signal equipment	Westinghouse Air Brake Co., Wilmerding, Pa.
Pistons; piston rods; crosshead; connecting rods; crank pins	The Timken Roller Bearing Co., Canton, Ohio.
Sectional piston rings	Locomotive Finished Material Co., Atchison, Kans.
Piston rod packing	U. S. Metallic Packing Co., Philadelphia, Pa.
Safety valves	Coale Muffler & Safety Valve Co., Baltimore, Md.
Operating valve and relay valve for air whistle	Viloco Railway Equipment Co., Chicago.
Poppett valve gear; power reverse gear	Franklin Railway Supply Co., Inc., New York.
Cylinder cocks; blow-off cocks	The Okadee Company, Chicago.
Boiler steel	Lukens Steel Co., Coatesville, Pa.
Tubes and flues; steam pipes.	National Tube Co., Pittsburgh, Pa.
Flexible staybolts	Flannery Bolt Co., Bridgeville, Pa.
Mechanical lubricators; lubricator check valve; oil distributors	Nathan Manufacturing Co., New York.
Booster (one locomotive)	Franklin Railway Supply Co., Inc., New York.
Booster control valve	Nathan Manufacturing Co., New York.
Alemite fittings—tender and engine	The Prime Mfg. Co., Milwaukee, Wis.
Booster steam- and exhaust-pipe lagging	Johns-Manville Sales Corp., New York.
Automatic lubricator manifold drains	The Okadee Company, Chicago.
Security circulators; brick arrangement for circulators	American Arch Co., Inc., New York.
Superheater	The Superheater Company, New York.
Multiple throttle	American Throttle Co., New York.
Steam-pipe covering	Union Asbestos & Rubber Co., Chicago.
Turbo feedwater heater	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Injectors	Wm. Sellers & Co., Inc., Philadelphia, Pa.
Stoker	Standard Stoker Co., Inc., New York.
Fire door	The Standard Locomotive Equipment Company, Toledo, Ohio.
Air whistle	Leslie Co., Lyndhurst, N. J.
Sanders	Graham-White Sander Corp., Roanoke, Va.
Headlight and generator	The Pyle-National Company, Chicago.
Bell ringer	Railway Service & Supply Corp., Indianapolis, Ind.
Cab window sash	The Adams & Westlake Co., Elkhart, Ind.
Clear vision cab window	The Prime Mfg. Co., Milwaukee, Wis.
Cab doors	The Morton Mfg. Co., Chicago.
Steel sheet for cab apron	Alan Wood Steel Co., Conshohocken, Pa.
Cab seat cushions	Dunlop Tire & Rubber Corp., Buffalo, N. Y.
Cab signals; train control	Union Switch & Signal Co., Swissvale, Pa.
Flexible connections between engine and tender; steam-heat connections	Barco Manufacturing Co., Chicago.
Tender:	
Frames	General Steel Castings Corp., Eddystone, Pa.
Tank steel	Carnegie-Illinois Steel Corp., Pittsburgh, Pa. Jos. T. Ryerson, Inc., Chicago.
Roller bearings	The Timken Roller Bearing Co., Canton, Ohio.
Coupler; coupler carrier; coupler release rigging; coupler yoke	National Malleable & Steel Castings Co., Cleveland, Ohio.
Draft gear	Waugh Equipment Co., New York.
Steam-heat connections	Vapor Car Heating Co., Inc., New York.

little space had been provided between the first and second, and third and fourth pairs of drivers that there was practically no clearance between treads of adjacent wheels at these points, and no room between adjacent wheel treads and rail for the two sets of heads and shoes usually located in this space on conventional clasp brake designs. Accordingly, it became necessary, at each of these close points to locate one head and shoe above the center line of the wheel and the adjacent head and shoe of the adjoining wheel below the center lines, both shoes being actuated by a single four-point lever, the middle portion of which cleared the outside faces of the drivers. Each of these levers was moved, during brake applications, by two brake beams, one at the top and the other at the bottom, which were then forced in opposite directions by two different sets of brake cylinders. The levers, shoes, heads, and beams were all supported by frame wearing plates above and below the upper brake beam.

Further driver brake complications were necessary be-



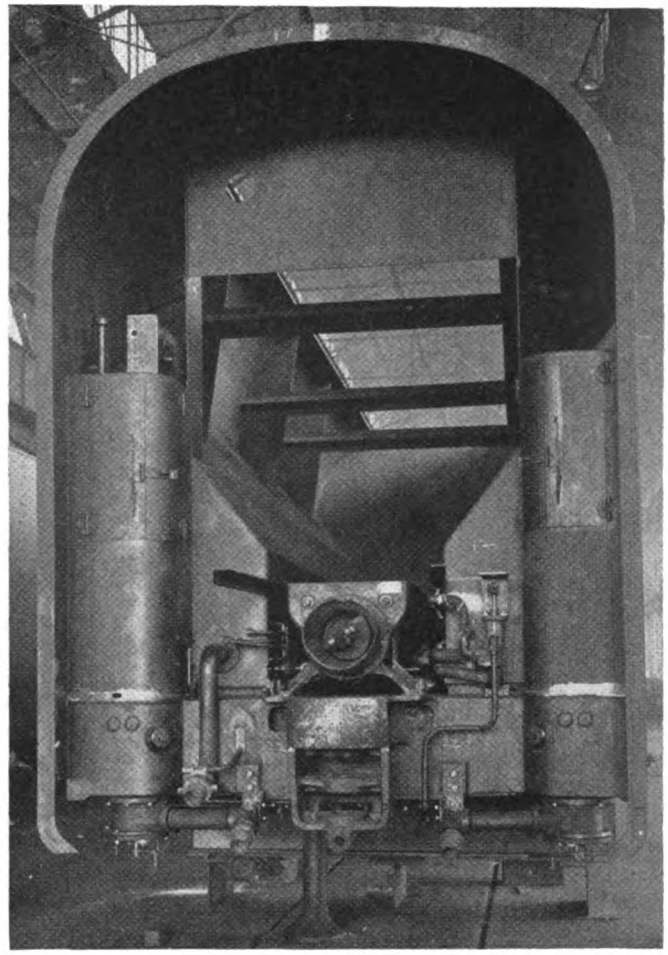
A section of the spring rigging showing hanger and equalizer details

cause of a 1-in. lateral movement, each side of the center line, in the first and third pairs of drivers. This required guiding members hinged at the top and bottom of the bearing housings to insure that the brake shoes followed the wheels in their lateral movements. It also required the use of a heavy pull rod with a swiveling jaw; and double-swing suspension of the transmitting and hanger levers at the drivers having lateral movement. This last provision introduced additional special construction in the top and bottom bearings of the four-point levers, as it became necessary to mount the beam journals in blocks having flat vertical faces but rounded top and bottom surfaces, thus allowing swing in a vertical plane, but not in a horizontal plane.

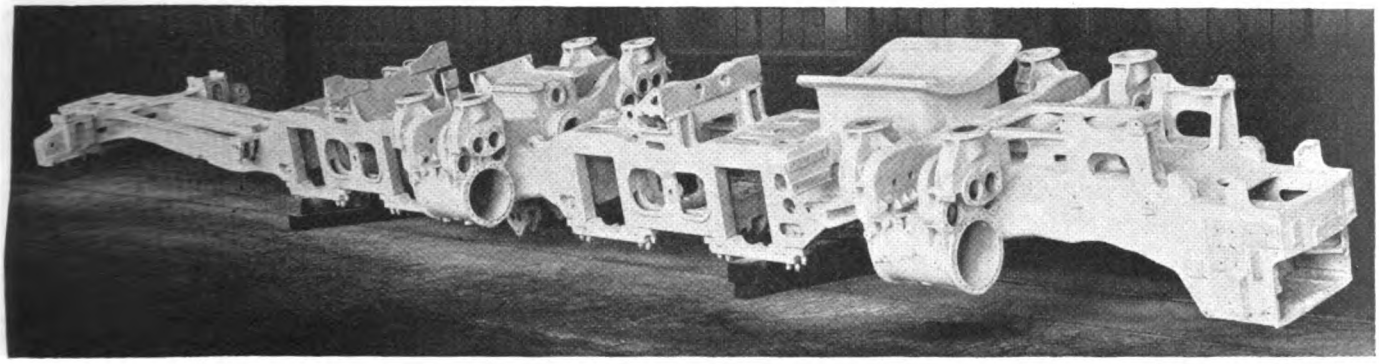
The trailer clasp brake arrangement was somewhat simpler, owing to greater clearance between the adjacent wheels. It was still necessary to hang one of the adjacent head and shoe combinations above the center, but it was then possible to apply the scissors type of twin lever, in which pressure at one end of the member applies equal pressure to both shoes.

The locomotive and tender brake equipment is Westinghouse HSC of the same type as on the S-1 locomotive except that it does not have electro-pneumatic speed control. Train air is supplied by two 8½-in. cross-compound compressors located at the front end of the frame behind the intercooler. The brake equipment is designed for 95 lb. emergency application. The braking power at 50 lb. cylinder pressure is 60 per cent on both engine trucks, 80 per cent on drivers and 120 per cent of empty tender weight. The train signal equipment is Westinghouse Type C.

The mechanical lubrication system consists of four Nathan DV-7 lubricators. Two of these are 16-feed units, one each for the poppet valves of front and rear engines. Eight feeds of each unit are for inlet valve stems and the other eight for exhaust valve stems. The



The front end of the tender



The bed, for both front and rear engines, is a single casting

internal mechanisms of gear and cam boxes operate in oil baths.

The other two mechanical units serve the cylinders, guides, booster (on the locomotive so equipped), stoker, exhaust-pipe expansion joint, sliding boiler supports, journal housing shoes and throttle stem. Alemite fittings for grease, in numerous locations on the chassis, complete the lubrication system.

The Tender

One of the railroad company's requirements for these locomotives was that they should be able to operate over the 713-mile territory between Harrisburg and Chicago with only one fuel stop. This is responsible for the unusually large fuel capacity of 41 tons. Water is taken from track pans while running by means of an air-operated water scoop so that the tender tank capacity need be only 19,500 gallons.

The rectangular U tank is mounted on a General Steel Castings Corporation cast-steel underframe in which provision is made for the stoker engine. The unusually large coal capacity necessitates the use of an exceptionally long stoker trough and conveyor screw.

The tender is carried on two General Steel Castings eight-wheel trucks. The trucks are equipped with Timken roller bearings.

Barco flexible connections are used between the engine and tender. Vapor steam-heat connectors are used at the rear of the tender. The tenders are equipped with National tight-lock couplers and Waugh draft gear.



Walter Henry Flynn

Chairman, Mechanical Division

Walter Henry Flynn

An outstanding railway mechanical department organizer and administrator

IN 1941 the New York Central System expended $92,454,568 for the maintenance of equipment—a very considerable operation, even in these days of big business. For 15 years Walter H. Flynn has headed up this department with unusual success, having under his direction approximately 29,450 employees, who maintain and repair the 3,440 locomotives, 127,656 freight-train cars and 4,557 passenger-train cars.

That Mr. Flynn is also highly regarded by the mechanical department officers of the railroads of North America is evident from the fact that he is chairman of the Mechanical Division of the Association of American Railroads.

By what route did he reach these positions of trust and eminence, which reflect administrative ability of a high order? What sort of a man is he?

Started Railroading Early

Walter Henry Flynn was born in Buffalo, N. Y., June 24, 1877. He spent most of his early life in St. Thomas, Ont., where his father was stationed as a master mechanic of the Michigan Central. It is said that the ambition to become a railroad mechanical man "took hold of him when he was just a rosy-cheeked lad with a shock of dark curly hair, and all of 10 or 12 years of age." Old timers on the Michigan Central report that at about that time he took over the "supervision" of the engine tracks and coal dock and soon had the men thereabouts "eating out of his hand." They all "loved the 'little devil,' as he was affectionately called, in spite of the fact that hostlers, on some occasions, had embarrassing moments with 'the boss,' explaining such things as damaged pilots and brake beams, which were found later by the inspectors; but these mysterious happenings were never accounted for."

At School and College

When Walter completed his grammar and high school training in St. Thomas, and also incidentally, what the railroaders regarded as his "primary mechanical course" at the shops and engine terminal, he was well prepared by the fall of 1895 for entering the engineering department of Michigan State College at East Lansing. He specialized in mechanical engineering and was graduated in 1899 with the degree of B.S.

Michigan State is a land grant college and military training was compulsory during the first two or three years for all able-bodied students, unless excused for some good reason. Engineering students, with their heavy programs, including time-consuming shop and laboratory work, were generally not keen about continuing the military training beyond what was absolutely required; and at that, many of them did not put forth much effort to excel in that department. Walter took a real interest in it, however, and in his senior year was appointed a captain of one of the four companies which made up the battalion.

This, however, was not the only evidence of leadership ability demonstrated in his college days. He was manager of the football team in 1898. So far as scholarship is concerned, a college mate reports that he "was the same at college as he is now—very active and industrious." He was elected to membership in Tau Beta Pi, an engineering college honor society.

Railroad Career Briefly Sketched

In September, following his graduation, he was employed as a mechanical draftsman in the office of the master mechanic of the Cleveland, Lorain & Wheeling, now a part of the Baltimore & Ohio. A year later, September 1, 1900, he entered the service of the Michigan Central at Detroit, as a draftsman in the mechanical engineer's office. On March 1, 1902, he was made assistant general foreman at the Jackson, Mich., shops.

An associate of Mr. Flynn's at that time says that he "was always the first man on the job in the morning and the last man to leave at night—a trait which has followed him right up to the present day."

To those who may have had assignments for taking indicator cards on passenger locomotives in the early part of the present century, the following report from a colleague of Mr. Flynn may stimulate vivid recollections. "We had received an Atlantic type locomotive and the management was desirous of making a test and obtaining some indicator cards. It devolved on Mr. Flynn to construct the platform on the front end for the use of the men taking the cards. The locomotive was assigned to Train No. 23, the Pacific Express. West of Kalamazoo, where the conditions were rather ideal, but the curves numerous, the engineer really opened her up. The old upright Boyer speed recorder edged up to the post, which was 90 miles an hour on the old type. We were certainly going! (That speed was unusual in those days.) There was a lull between taking the cards and Mr. Flynn and I crawled down behind the protecting boards across the front end. He inquired as to what would happen if we unfortunately hit a cow; you can imagine my reply and the laughter that ensued, which was audible even above the exhaust of the locomotive."

On February 1, 1905, Mr. Flynn was promoted to general foreman at the Jackson shop. With an excellent foundation in both the designing and the maintaining of equipment, his early experience still remained to be rounded out with a third phase—mechanical operation—and on September 1, 1907, he was promoted to master mechanic, with headquarters at St. Thomas. He thus returned to his boyhood home and to the position formerly held by his father. On June 1, 1912, he was made superintendent motive power of the Michigan Central, with headquarters at Detroit. On April 16, 1925, he

was called to New York as superintendent motive power of the New York Central, Lines East. In September, 1926, he was made general superintendent motive power of the New York Central, and in January, 1927, was advanced to general superintendent motive power and rolling stock, which position he now holds.

The organization of the mechanical department on the New York Central differs from that on most railroads. It is made up of two divisions, the heads of which report to the executive vice-president. The equipment maintenance section is headed by Mr. Flynn; and the equipment engineering department by Paul W. Kiefer. Naturally, certain important aspects of the work are intimately related, or interrelated, and must be acted upon jointly. An attitude of constructive and wholehearted co-operation is thus essential on the part of the two leaders and their respective staffs. Needless to say such a spirit does exist.

The equipment maintenance division also overlaps the operating department to the extent that the locomotive firemen and engineers are trained and supervised, so far as craftsmanship is concerned, by the mechanical department.

This, in brief, sketches Mr. Flynn's early training and railroad career. Now for a more intimate picture of the man, his accomplishments, and the way he works.

Thoroughness Stands Out Prominently

As one studies him through the eyes of his associates, a certain quality stands out prominently, i.e., his thoroughness. Says one of them, "His thoroughness of handling any subject has made him so well informed on all subjects connected with the mechanical department of the railroads that you can well class his opinion as authority on such matters. His curiosity has always driven him to ferret out the whys and wherefores of any subject which came to his notice and, I will say, not very many escaped his eye. He was never satisfied until the final solution was found. He has the gift of weighing carefully any decision he has to make and does not allow anyone to influence him in making it. He will take the time to find out for himself and then act."

Another associate—one who has known him since his college days—says: "I marvel at his ability to master detail. Mr. Flynn does not rely on his subordinates with regard to any detail of his locomotives and cars, or the numerous rules and regulations governing their maintenance."

Says still another: "His progress, though of moderate momentum and not conspicuously perceptible from day to day, resulted in the end in that sure attainment that is the cumulative result of diligent and faithful attention to the tasks of each passing day."

A Good Operating Man

Possibly when still a lad he may have sensed the fact that the real objective of a railroad organization is to furnish transportation, and that the mechanical department is only one means toward that end. At any rate, the man who was superintendent at St. Thomas when Mr. Flynn became master mechanic and who was associated with him for many years thereafter, speaks of him as "an operating man of great ability. He was at all times working to produce better mechanical performances and first-class operation. Very few men possess these joint abilities, so necessary for the successful operation and financial showing of any railroad property."

To support this statement the operating officer cites the following incident as typical:

"In 1911 we had placed before us a most difficult passenger operation; the meeting of a Twentieth Century operation between Detroit and New York on the basis of our pro-rated mileage from Detroit to Buffalo. We had to start with delays for customs and immigration between Detroit and Windsor, also Bridgeburg, Ont., and Black Rock, N. Y., frontiers—where delays were always met with—and also a fixed arbitrary of 13 minutes to run from Black Rock to Buffalo—four miles—over tracks of another railroad. With these handicaps before us, a problem was presented that looked almost impossible. We had a meeting one Sunday morning—superintendent, master mechanic, road foreman, trainmaster and five of our passenger engineers. I told the group what we were confronted with and stated it looked to me like a schedule of 102 minutes for 110 miles, Windsor to St. Thomas, and 113 minutes for 118 miles, St. Thomas to Bridgeburg, with from five to eight Pullman cars.

"There was a general shaking of heads, but after eight hours of effort a schedule was worked out on that basis. What always impressed me was the way the mechanical operation was worked out and the perfect understanding that was had by each person present that this operation was safe, practical and feasible; Walter Flynn's judgment was good, and later on, operating results confirmed it in every detail. The train was operated from the Old Station on the river and a backup was made to the west end of the new tunnel under the river. Our division received the trains 15 to 25 minutes late every day at Windsor. We ran the train every night from Windsor to St. Thomas in 96 to 98 minutes, and into Buffalo for the first three months 99½ per cent on time. This, at that time, was the fastest scheduled train in the world. President Smith later almost broke our hearts by ordering 30 minutes more in the schedule of the 'Detroiter,' which we always considered had established a record that we could justly feel proud of.

"When Mr. Flynn was called to Detroit in 1912 he met the difficult problems he found and for the next 14 years he was responsible for a very satisfactory and successful mechanical operation, equal to any in the country on any railroad. We were in front ranks in starting running passenger engines through long distances—Detroit-Chicago—and the operations were very successful, thanks to Mr. Flynn's close attention. One could go on indefinitely giving instances to demonstrate his mechanical-operating ability."

Incidentally, as any experienced railroader knows, there are plenty of opportunities for interdepartmental misunderstandings and friction. The railroad suffers when different departments work at cross purposes. Maximum efficiency depends on a unity of purpose and harmonious striving to achieve a common objective. Mr. Flynn, according to his associates, has been unusually successful in "ironing out" rough spots. This has been accomplished, not by issuing orders or by disciplinary measures, but in a quiet, unobtrusive way and largely by the power of suggestion. He seems to have a special ability in inducing a friendly co-operative spirit to replace one of faultfinding and noncooperation.

A Labor Leader's Viewpoint

It is not surprising, in light of what has already been said, to learn that Mr. Flynn has been successful in dealing with the most difficult problem in railroad op-

eration—that of employee relations. This may possibly best be placed on record by quoting from a labor leader who was associated with him for many years.

"In the early days," says this leader, "questions between labor and management were handled in the hard-fisted manner; you sat across the table and told each other what you thought and did not draw your punches. I make mention of this, because I feel that the opportunity to size men up as to their feelings toward the worker were greater then, than now.

"Mr. Flynn is one who recognizes the necessity of labor to organize and act collectively and he encourages rather than discourages organization of employees. If you can picture in your mind a man with this principle, you can readily see that in his dealings where the worker is concerned, he is quite apt to look upon labor matters in a humane, fair and equitable way.

"During the years we dealt with each other we were confronted with just about any kind of a situation that would arise involving labor and management. In every instance I found Mr. Flynn ready and willing to discuss the situation in an endeavor to reach an amicable settlement. This has been a valuable asset to both the company and the workers, for the attitude of the immediate supervision quite generally patterns from the head of the department."

More About Employee Relations

Mr. Flynn was superintendent of motive power and equipment of the Michigan Central during the shop crafts strike in 1922. An observer, close to him at that time, comments on the fact that he had the situation in hand better than many other roads, because he knew the Michigan Central personnel so well. "I attributed the results very largely," says this observer, "to the confidence which the supervision—foremen and up—had in the higher bosses. The foremen, as well, evidently were close to the men—all of which spoke well to me of proper organization. As you know, this can only be developed by steady and consistent treatment."

When Mr. Flynn went to New York in 1925 he found many serious complications growing out of the strike settlement. The System succeeded, however, in "building up sound relations with the committees and working out solutions to an extent which could not have been accomplished if he (Mr. Flynn) had not devoted so much of his time and energies to proper relations between the immediate supervision and the forces."

The relatively small number of grievances which have to be appealed from the point of origin to the higher motive power officials on the New York Central is the best evidence of satisfactory relations between supervision and the employee groups. "This," says an associate, "could not have been the case unless the employees had confidence in the man at the top."

A sidelight on Mr. Flynn's interest in the employees' welfare is his association with the Railroad Y. M. C. A., most of whose members are locomotive engineers and firemen, trainmen, shopmen and members of the clerical staff. He served as the president of the Railroad Y. M. C. A. at West Detroit for many years, taking a most active interest in its operations. "The outstanding impression I have of him," says one of the traveling executives of the Railroad Y. M. C. A., whose territory included the Michigan Central, "is his cheery disposi-



When Walter Flynn was made master mechanic of the Michigan Central in 1907

Bottom row, left to right: A. Link, master mechanic, W. Detroit; W. H. Flynn, master mechanic, St. Thomas.—Second row: George E. Parks, master mechanic, Jackson; D. R. MacBain, assistant superintendent motive power; E. D. Bronner, superintendent motive power; J. A. McRae, mechanical engineer.—Center, between second and top rows: Tom J. Hennessey, master mechanic, W. Bay City.—Top row: W. H. Corbett, road foreman, Jackson; Dave Meadows, assistant master mechanic, St. Thomas; E. Russell Webb, master mechanic, Michigan City; M. J. McAndrews, road foreman, St. Thomas; J. F. Jennings, road foreman, Detroit; C. McCormick, chief clerk to superintendent motive power.

tion, his readiness to give practical suggestions about the work of the Railroad Y. M. C. A., and his open-door policy that made it possible for me to see him whenever it seemed desirable."

As to Discipline

While Walter Flynn is a man of extreme fairness, at times leaning over backwards to be fair and equitable in his dealings with others, it must not be assumed that he is soft and uncertain in discipline. One of the kindliest men, he is at the same time a firm disciplinarian.

Sloppy work or lamentable behavior never go unnoticed by him; on the other hand, commendable deeds are treated in the same way. Both types of comment, however, are always meted out in private. "I have known cases," says one of his associates, "where men have made mistakes and admitted their fault and have been given kindly advice and correction, but woe betide the man who would lie deliberately to get out of difficulty, as that was one failing that Mr. Flynn would never tolerate and he has an uncanny faculty of sorting out truth from fiction. He is a keen observer and appears to sense when some job that might not rate 100 per cent is being 'covered.' I have heard some mechanics remark, 'Stick it right out in the open; that is the only way the Boss might miss it.'"

A humorous incident happened in a certain shop where the local official heard at a late hour that the "Boss" would be in town. Strenuous efforts were made to clean the shop; all material was placed outside the white line for safety and the shop was swept clean; a real camouflage job was done by sweeping the dirt well back under the benches. The "Boss" arrived and after passing the first bench requested that they see what could be found under the benches. Needless to say, there was plenty of material and sweepings and the shops were not allowed to let up until all the benches had a thorough cleaning both inside and out.

Another incident is told of a fire practice at a certain shop where they always put on a real show for the "Boss"; it was always done in split second time. On one occasion the stage was all set and the men advised that a certain station would be signaled by the fire whistle. Mr. Flynn was apparently wise and at the appointed time pulled another station—the boys answered the call, but they had started in the wrong direction and had to retrace their steps, much to the embarrassment of the fire chief, who, it is said, profited by the experience.

Technical Achievements

Incidental reference has already been made to Mr. Flynn's activity in extending the length of locomotive passenger runs on the Michigan Central. He has played a most important part in the campaign for greater utilization of locomotives in all types of service, and since 1934 has served as a member of the Joint Committee of the A. A. R. on Utilization of Locomotives and Conservation of Fuel.

Comparable figures for locomotive utilization are not available on the New York Central prior to 1930. It is instructive, however, to compare the first eight months of that year with the corresponding period in 1942. The locomotives in service, including freight, passenger and switch engines, decreased from 5,039 to 3,451, or a reduction of 31.5 per cent. During the same period the reduction in locomotive-miles was only 1.7 per cent. Passenger car-miles were substantially the same, but the freight car-miles increased over 22 per cent.

In August, 1930, the locomotive-miles per day per serviceable freight locomotive (including stored locomotives) was 68.5, and in August, 1942, this had increased to 121.6 or 77.5 per cent. In the same period the gross ton-miles per freight locomotive-mile increased 15.3 per cent.

Closely associated with the greater utilization of locomotives has been the stepping up of standards of maintenance of both locomotives and cars. This has involved the centralization and rehabilitation of shop and repair facilities, and radical changes in the methods of organization and operation.

The introduction of shop scheduling systems has facilitated the making of locomotive repairs, increasing the shop output per pit per month and reducing the number of locomotives out of service for repairs. The shopping of freight cars by classes, rather than on a run-of-mine basis, and the introduction of the progressive system of rebuilding and making repairs has speeded up production and reduced out-of-service time. Similar methods, so far as practicable, have been applied to the repair and rebuilding of passenger cars.

In 1927, fifteen years ago, when Mr. Flynn was appointed to his present position, the New York Central System had a total of 19 shops, which were classified as locomotive repair shops. Several of these, however, were not what might be called major shops. As a result of changes which have been made from time to time, the general repair of locomotives has been consolidated into six principal shops at central locations in the several operating districts.

In the same manner, the heavy car repair work which in 1927 was performed in 23 miscellaneous shops has been consolidated into four major shops.

During the same period there has also been a reduction in the number of engine terminals on the system from 203 to 150.

Training Men—Young and Old

Mr. Flynn has always taken a sympathetic interest in the training of the younger men in his department. Particularly on the Michigan Central he visited the apprentice schools periodically, giving encouragement to the boys and their instructors. While he may not have been able to do this on the same scale, as he assumed larger responsibilities on the System, yet working through others he has constantly sought to improve the training methods, and to help the young men to develop themselves to the full extent of their abilities. Few mechanical officers felt so keenly the necessity for slowing down the training methods during the "thirties."

It is significant, also, that today hundreds of the gang leaders, foremen and supervisors are receiveing special training in foremanship and leadership.

Arbitration Committee

Probably one of the most important, and at the same time the most difficult assignments in the Mechanical Division of the Association of American Railroads is membership on its Arbitration Committee. It is the duty of that committee to settle disputes arising between the members under the Rules of Interchange; to recommend at each convention such changes, suggestions, amendments or additions to the Rules of Interchange as may be thought advisable. Mr. Flynn became a member of that committee in 1931 and succeeded to the chairmanship in 1934; he was elected chairman of the Mechanical Division in 1940.

One of the members of the Arbitration Committee

says that after he became chairman, "it soon became evident that his many years of experience with operating rules, in dealing with men and mechanical problems, his keen analytical mind and rare common sense, coupled with a fine sense of fairness, eminently qualified him for the work. He never jumped at conclusions. He always wanted to hear both sides of an argument, to which he would listen with great patience. After having done so, however, he intuitively and with little concern, reached a just and proper decision."

Another close observer of the operations of the Arbitration Committee refers to his "very tactful handling" and points out that "his courteous conduct at all times endears him not only to all the mechanical officers with whom he comes in contact, but also the shippers, tank car operators and private lines representatives."

Relations with Supply Representatives

Walter Flynn is popular among railway supply representatives and manufacturers, as he is with railroad men. "From a commercial standpoint," reports a friend in the supply field, "he gives no more consideration to a friend when it comes to something we might wish to interest him in, or sell him, than he does to anyone whom he might have seen for the first time. It is strictly business with him and the New York Central comes first."

Says another railway supply representatve: "Mr. Flynn is one of the hardest working men that I know, and yet a visitor in his office never feels that he is being hurried or that his call is an intrusion, or is interfering with his work. Yet I have known him, after giving time to visitors from his very busy day, to remain after hours to complete work which he felt should be done before calling it a day."

Hobbies

In a strict sense Mr. Flynn has no hobbies. His work and his family occupy him entirely and he loves them both. He does play a little golf—but not much. "Even in the game of golf," says a friend, "he is as intense as he is at his desk or on the road."

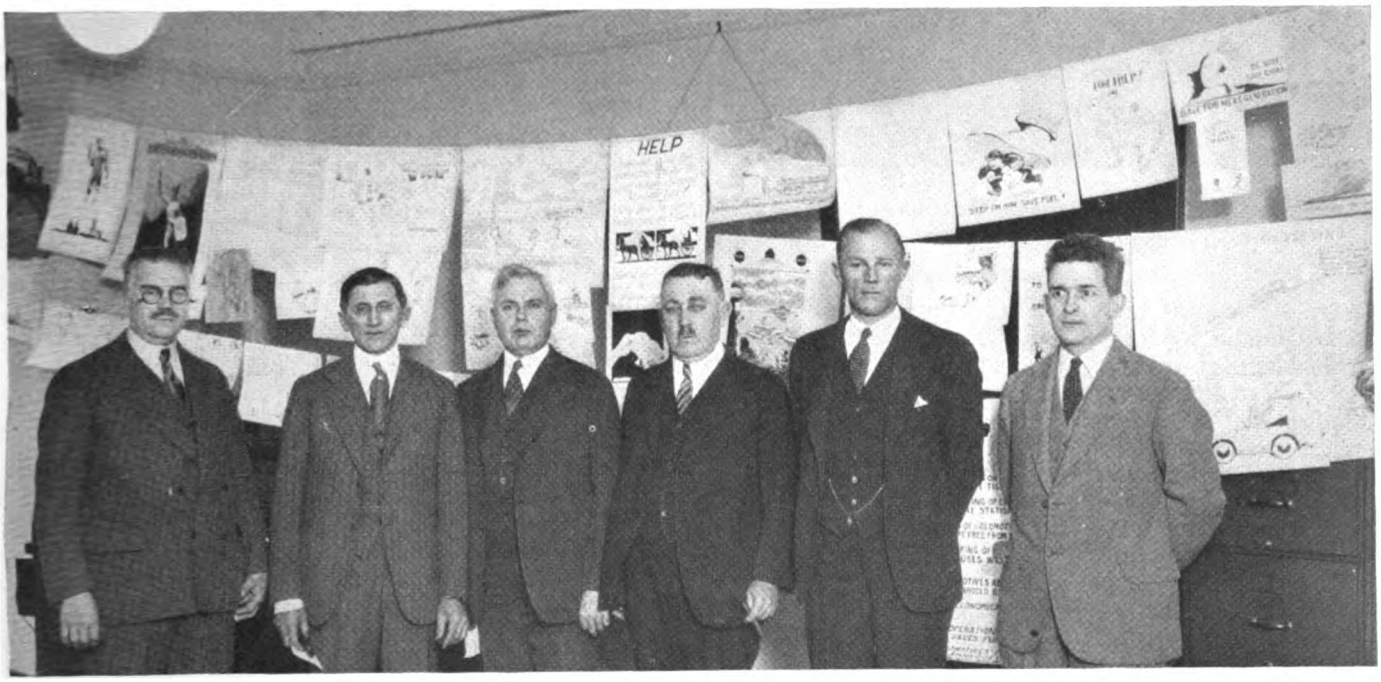
His hobby is in truth his vocation. It has even been suggested that if he had time for a hobby it would be operating a fully equipped scale model of the entire New York Central System. On rare occasions he manages to slip off to his camp in the White Mountains for a little rest and relaxation.

Summing Up

Industrial leaders, as well as railroad officers, are exerting every effort to speed up production in the war emergency . All along the line, from the executives down through the foremen and supervisors and men in the ranks, efforts are being made to do a more effective and more efficient job.

Railroad mechanical department officers, with diversified forces spread out in large and small groups over great areas, often embracing several states, are confronted with an unusually difficult task. The industrial executive, with highly concentrated forces in a single plant, can well afford to study the successful railroad mechanical leaders whose skill must indeed be magnified to cope with the complicated and difficult problems with which they are confronted.

New York Central executives have the reputation of spending much time on the road—out on the firing line, so to speak—and Mr. Flynn is no exception to that practice. Thoroughly versed in the details of mechanical department equipment and practices, he also possesses those qualities which make for leadership—the ability to select and develop capable subordinates and to inspire them and the men under them, down into the very ranks, with a spirit of loyalty and co-operation. Modest and unassuming, with an aversion to publicity, in a quiet but effective way he exerts a powerful influence, which is clearly reflected in the high standards of equipment maintenance and operation on the New York Central.



New York Central committee which judged fuel conservation posters in an employees' competition in the Spring of 1930

Left to right: C. W. Y. Currie, publicity manager; J. V. Neubert, chief engineer, maintenance of way; Walter H. Flynn, general superintendent motive power and rolling stock; D. W. Dinan, general manager; F. H. Hardin, assistant to president; A. A. Raymond, superintendent of fuel and locomotive performance.

Railroads' Use of

Flame Hardening Processes*

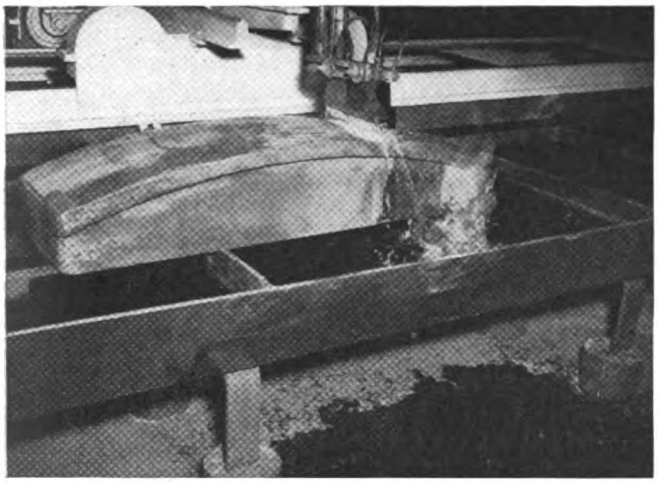
Part II

By F. C. Hasse†

Carbon content determines possibility of successful applications—Numerous locomotive and car parts now flame-hardened—Experiments are continuing to extend usefulness of the process

In general, any steel that can be hardened by simple heating and quenching with water or air can be flame-hardened. The degree to which plain carbon steels can be quench-hardened is dependent upon the carbon content of the steel. To obtain reasonable increase in hardness, the steel should contain at least 0.40 per cent carbon. As the carbon content increases, the hardness obtainable increases. The general range for plain carbon steel is from 0.35 to 0.70 per cent carbon. Steels with greater carbon percentage can be flame-hardened, but greater care is required in their treatment to avoid checking. To provide a less drastic quench, the quenching medium generally used for the steels with higher carbon content is air or an air-water mist.

The most desirable steels for flame-hardening are carbon or low-alloy steels. These usually harden to a good degree, and, except for certain types, will usually withstand heating and quenching without checking or cracking. Locomotive axle steel has been found satisfactory. It is suitable for forging and shaping and is readily machinable, thus serving as a satisfactory material for many locomotive and car parts.



Locomotive radial buffer castings are hardened with two 30-flame heads

Tables are available showing in detail the various steels that can be successfully flame-hardened, together with their complete analysis and hardness results.

A great many grades of cast iron, both with and without special alloying elements, have been found to respond quite satisfactorily to the flame-hardening process. Cast iron is basically a steel matrix in which are embedded numerous particles of free graphitic carbon. In the flame-hardening process this matrix is hardened, the graphite inclusions playing a minor part and remaining practically intact in the hardened material. It is the combined carbon content of the cast iron that controls the susceptibility of the material to flame-hardening and quenching. Considering the cast-iron matrix in the light of what has been stated regarding the carbon content of steels to be flame-hardened, it must follow that the combined carbon content of a cast iron to be treated by this method must be somewhere in the range of 0.40 to 0.85 per cent.

Available evidence on the subject points to the fact that both plain and alloy cast iron can be successfully flame-hardened, with little difference in final results, by giving proper consideration to the effect of the alloying elements present. The importance of the alloying elements lies in their effect upon the physical properties of the material rather than upon the flame-hardening process. The inclusion of the usual small amount of special alloying elements, such as chromium, nickel, molybdenum, or vanadium, has little important effect upon the hardening of the material by the flame-hardening process. As in steel, these elements tend to lower the transformation or critical temperature and will allow hardening to be accomplished at a lower temperature. On the other hand, certain of the carbide-stabilizing elements will necessitate a higher temperature for complete solution before quenching.

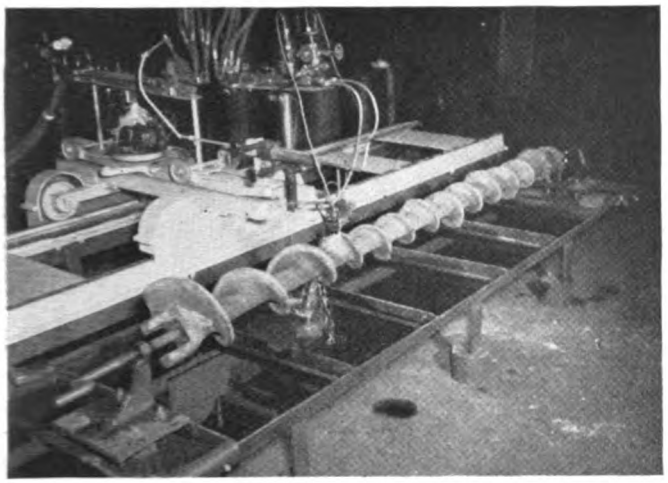
Cast iron has a large field of usefulness as an engineering material; and when chilled, it has a high resistance to wear. Much higher machining costs, however, ordinarily prevent the use of chilled castings where machined surfaces are required and where dimensional accuracy is important. Here flame-hardening is particularly useful since the softer cast irons which have not been chilled can be easily machined and then flame-hardened to produce the required hardness and wearing properties.

The flame-hardening of fully malleabilized cast iron cannot be considered as entirely successful. In this material, essentially all of the carbon present is in the graphitic form, the matrix being almost entirely carbide-free ferrite. The time element involved in flame-hardening is too short to allow a satisfactory reabsorption of the free carbon into the matrix to produce a uniformly hardened material. Fully malleableized iron may be given a pretreatment of a nature that will result in the absorption of

* Paper read before meeting of Southern and Southwestern Railway Club, Atlanta, Ga., September 17, 1942. (Part I of this paper appeared in the December, 1942, issue.)

† General manager, The Oxweld Railroad Service Company, Chicago.

a sufficient amount of combined carbon in the matrix to allow response to the flame-hardening treatment, but this treatment alters drastically the physical properties of the malleable iron. Some of the so-called pearlitic malleable



Stoker screws are rotated under two transversely moving flame-hardening heads; this is the spiral progressive method of hardening

irons that contain a sufficient amount of combined carbon have been found to respond with complete satisfaction to flame-hardening.

Necessary Surface Conditions

Since flame-hardening is only surface hardening and since only a comparatively thin layer is treated, it is of vital importance that the surface be in the proper condition to react successfully to the hardening. In the processes of forging, casting, normalizing, annealing, and in certain heat-treating processes, carbon may be extracted from the surface of the material, leaving a decarburized layer which will not harden, as this zone may be entirely lacking in carbon or the percentage of carbon reduced below the hardening range.

It is essential that decarburized surfaces be removed prior to the hardening operation. If they are not removed soft spots will occur in these zones. Decarburized metal can be taken off by machining or grinding, depending on which procedure is most suitable, convenient, or economical.

Pits and blowholes in the metal surface should be avoided. Occasionally there are instances where these defects may be covered by a thin layer of surface metal or scale which will fuse when the heat from the blowpipe is applied and the blowhole will be exposed. This is a defect in material and is not the fault of the operator although often he is blamed.

Seams and laps are material defects which have to be avoided. These flaws generally develop cracks during the quenching operation. Where either electric-arc or oxy-acetylene welding is used to reclaim a part before the machining and hardening, it is necessary to fuse the weld metal well and avoid laps. When the weld metal has just been melted and deposited without proper fusion with the base metal, a melting through will result when the hardening flame strikes the welded area.

Scale has a heat-retarding influence and where maximum hardness is desired, the surface should be thoroughly cleaned of scale before submitting it to the hardening operation. Scale can be readily removed by grinding, using a steel brush or oxy-acetylene flame-cleaning.

In general, do not expect to flame-harden with success these materials containing defects that make it impossible for them to be hardened by the more common methods.

After a flame-hardened part has been in service long enough to warrant removal for reclaiming, the remaining hardened areas can be softened or annealed by the usual furnace method, or the part or area can be heated with an oxy-acetylene flame sufficiently to draw the hardness so that the part can be machined. If, after flame-hardening, some re-forming is necessary, grinding is indicated. A soft, wet wheel of the type used for grinding high-carbon tool bits serves best because the harder wheels may develop sufficient heat at the surface of the metal to cause thermal cracks.

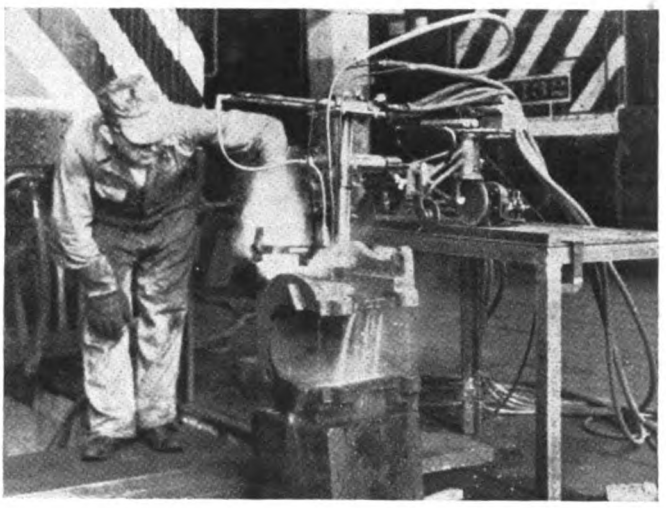
Estimating Costs

It has been found that to flame-harden one square inch of steel requires about one-quarter of a cubic foot each of oxygen and acetylene. This figure has often been found to be high but it will serve as a basis for general estimating purposes. Costs of oxygen and acetylene have been determined for most of the applications quoted and the manufacturers of the gases have data available on specific jobs and conditions. Labor cost is difficult to estimate because so much depends upon shop facilities and the degree of mechanization of the application.

Applications on the Railroads

The possible applications of flame-hardening in the railroad field are numerous. A few typical applications will serve to illustrate the tremendous possibilities of the process.

One of the first applications in a locomotive shop was in the flame-hardening of crosshead guides. Guides are



Surfaces on locomotive trailer truck boxes are flame-hardened from an original 210 Brinell to 530 Brinell

generally forged from old axles, and have an approximate carbon content of 0.45 to 0.50 per cent. This material is ideal for flame-hardening. The hardness before treating is generally 180 to 200 Brinell and after hardening is about 500 to 600 Brinell. The service life of flame-hardened guides has been found to be at least tripled. As an actual mileage test after 50,000 miles of freight service, an unhardened guide was worn ⅛ in. on the sides and top, whereas the flame-hardened guide on the other side of the same locomotive was worn only 0.007 in.

An operation that has received much attention lately, because of the shortage of strategic materials, is the flame-hardening of steel driving-box shoes. The shoes have been either cast or flame-cut from steel of sufficient carbon content for satisfactory flame-hardening. Steel

castings have beeen raised to 450 Brinell; and axle-steel shoes, to 600 Brinell.

Pedestal fits on driving boxes are being hardened successfully. The hardness has been raised on new cast-steel boxes from 210 Brinell before treatment to 530 after treatment. The service life of both driving boxes and shoes has been tripled by this treatment.

Rockers and rocker seats, when worn, are generally reclaimed by oxy-acetylene welding, using a 0.40 to 0.50 per cent carbon welding rod followed by flame-hardening. The service life is doubled and, in many instances, tripled by this procedure. The rockers, both the engine- and trailer-truck types, require about 10 min. hardening time.

Spring Parts

Spring saddles, when worn, are reclaimed by oxy-acetylene welding, using the high-carbon rod and flame-hardening. The hardness obtained is about 550 Brinell. The hardening time is approximately 4 min. It has been found that after 80,000 locomotive miles no wear is evident on the flame-hardened surfaces.

Flame-hardened spring equalizers, after 165,000 miles of service still show very little wear. The parts are generally made of low-carbon steel and must have the wearing edges built up with a high-carbon welding rod, after which a hardness of 600 Brinell is obtained by flame-hardening.

Other Typical Applications

A link and link block, each made of axle steel, were flame-hardened. After a year's service, the locomotive on which they were applied was returned to the shop for repairs. Upon inspection no wear on the parts was apparent and they were placed back in service again. Now, after 20 months of service no wear has been found. Blocks of this type can be flame-hardened to 600 Brinell in 3 min.; links can be hardened in 10 min.

Many chafing or radial buffer castings are made with a chilled surface. When service-worn they can be reclaimed by welding and flame-hardening. Castings so treated have run 100,000 miles with no wear detectable.

No mileage records for piston heads having flame-hardened ring grooves are yet available but this operation promises to exceed all predictions as an economical procedure. The ring grooves in cast-steel piston heads have been flame-hardened to 500 Brinell in approximately 30 min. New heads are expensive and when worn only slightly must be either scrapped or reclaimed.

Miscellaneous pins, such as crosshead wrist pins, knuckle pins, spring-hanger pins, and trailer center pins, can be flame-hardened economically. A crosshead wrist pin flame-hardened by the oxy-acetylene process has been run 110,000 miles with only 0.002-in. of wear.

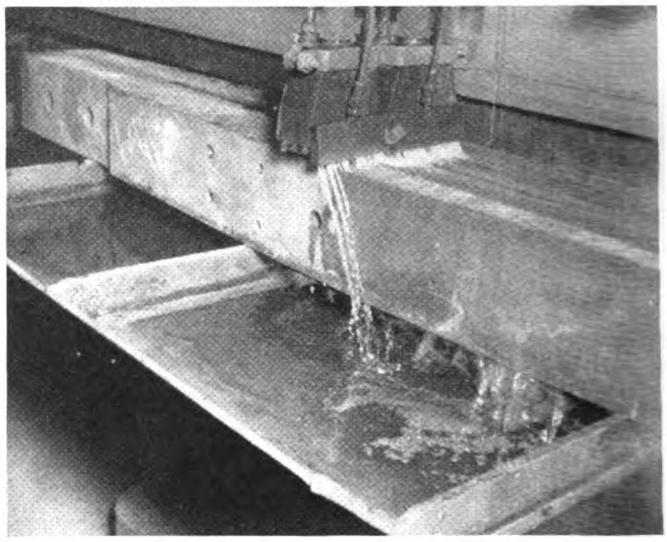
Other locomotive parts that have been, and are being flame-hardened are: valve-pilot wheels, radius bar for combination lever, valve crosshead guides, valve crossheads, power reverse guides, piston and valve packing rings and stoker screws, racks, and gears.

Flame-Hardening in Car Shops

In car shops, draft keys, made of A. A. R. Class A, No. M-104 steel which has 0.40 to 0.50 per cent carbon, have been flame-hardened to 500 Brinell.

Flame-hardened passenger-car V-type and flat-belt-type pulley wheels used to drive motor-generators have given excellent service. These sheaves are generally made of cast iron or cast steel. A 10½-in. dia. V-type pulley with three grooves can be flame-hardened in 20 min.

A flat-belt cast-iron pulley wheel of 7½-in. dia. with an 8¾-in. face was flame-hardened in 6 min. The final hardness was 514 Brinell. With this type of pulley, the difficulty is not in breakage of the pulleys, but the loss of service and belt life when the crown of the wheel becomes worn. When flame-hardened, such a wheel was in service for three years on a passenger run between Chicago and the west coast. On this wheel only a 4-in. width at the crown had been hardened. At the end of the three years that area showed no wear but the adjacent soft areas were worn wavy from the slap of the belt. The procedure on this particular railroad has now been changed and the entire width of the pulley tread is hardened.



Flame hardening the face and two sides of crosshead guides triples their service life

Journal Boxes and Wedges

Wear tests on flame-hardened cast-iron journal boxes for passenger cars are at present in progress. Results are not yet definite but a substantial increase in life can be expected. The boxes were hardened, both on the equalizer seat and on the pedestal fit. The material used contained 0.69 per cent combined carbon and was hardened to 400 Brinell.

A wear test of flame-hardened journal-brass wedges has been in progress since June, 1939, on regular Pullman cars running between Chicago and New York. Results on this test will not be known until the test is completed. Wedges made from steel forgings, with sufficient carbon, can be hardened to 540 Brinell. This operation can readily be adapted to an automatic and continuous setup because of the large number of pieces to be flame-hardened.

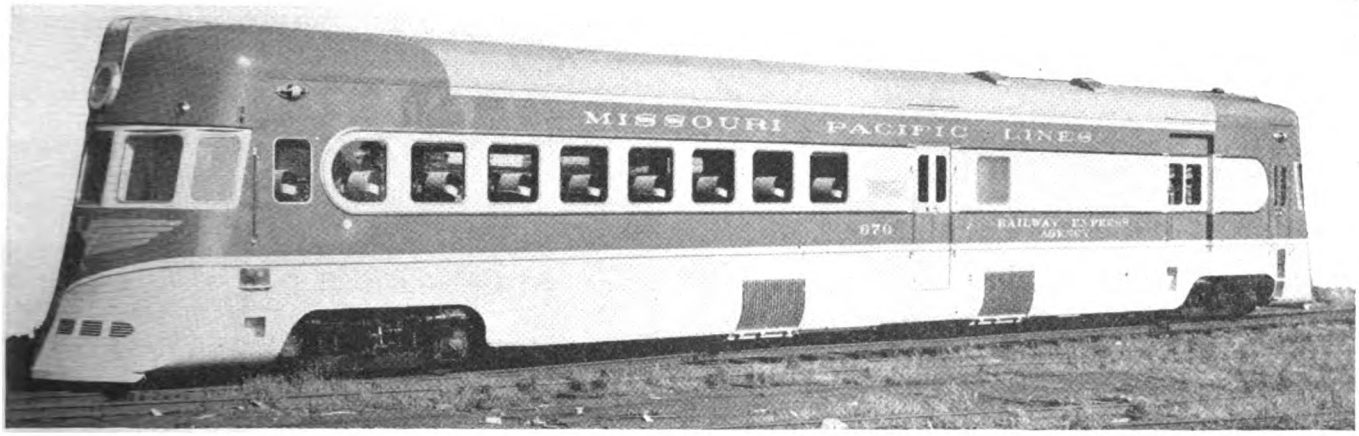
Other passenger- and freight-car parts which are flame-hardened are: equalizer-seat inserts for journal boxes, various wear plates made of carbon steel for riveting or welding to wearing surfaces, half pedestal castings, pedestal castings, draft-gear V-blocks, coupler carrying irons, coupler lock blocks, and side and center buffer stems.

Work Equipment

A number of interesting miscellaneous applications have been made on work equipment and on items for use in a railroad shop and on parts for the right of way.

Several frogs have been flame-hardened and are now in service for test. The frogs were fabricated from 85-lb.

(*Continued on page 24*)



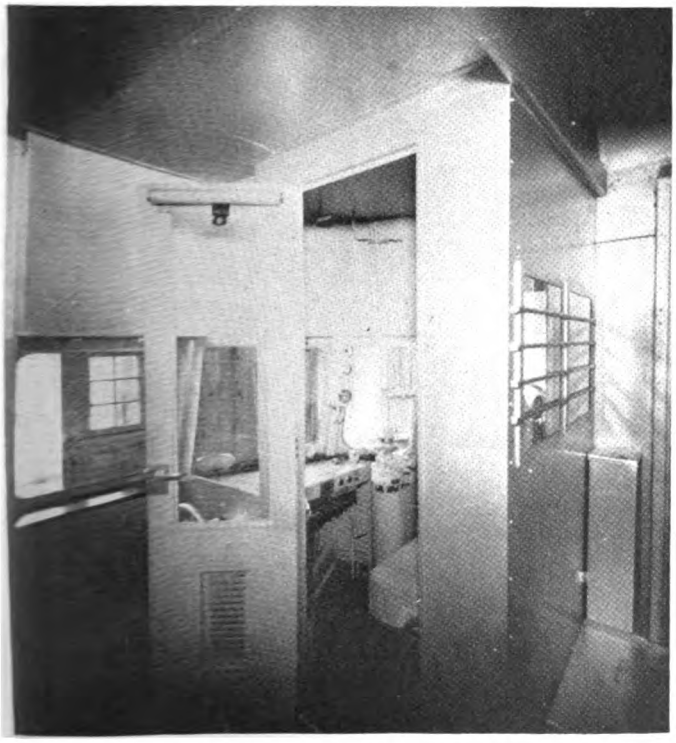
Missouri Pacific motor car with power plants under the floor

Missouri Pacific Motorailer

Car delivered by American Car and Foundry Company renders connecting service for Missouri River "Eagles"—Seats 34 passengers and has baggage compartment—Two Waukesha oil-engine-generator sets mounted under the car body

A DOUBLE-end Motorailer has recently been delivered to the Missouri Pacific by the American Car and Foundry Company. This car, which is designed to develop a maximum speed of 70 miles an hour, will operate between Lincoln, Neb., and Union where it will make connections with the Missouri River "Eagle" trains running into and out of Omaha, Neb. The run is 47.7 miles long in each direction, and the car will make two round trips per day. It will be maintained at the Lincoln enginehouse.

The car is arranged with a center vestibule, a baggage compartment at one end to carry 10,000 lb., and a passenger compartment at the other end seating thirty-four.



Looking into the operator's compartment

Interior finish and trim in the passenger compartment and the exterior color scheme both match the Eagle trains, the predominant colors being blue and gray. The passenger compartment is air conditioned.

Power is supplied by two 210-hp. underbody-mounted Waukesha spark-ignition oil engines through Twin Disc clutches and torque converters to geared drive axles, each engine driving at one truck. The engines are capable of accelerating the car to its top speed of 70 m. p. h. in 3.5 min. over a distance of 2.6 miles on level tangent track.

The vestibule is built with open-step wells. The lower step revolves through 90 deg. and carries a section of skirt so that in the closed, or up, position of the step the skirt line is continuous.

The seats have individual reclining backs and are of

Principal Dimensions and Weights of the Missouri Pacific Motorailer

Length overall, ft.-in.	75-0
Width over side sills, ft.-in.	9-6
Height, rail to top of carline, ft.-in.	12-6⅜
Height, rail to top of floor, ft.-in.	3-10
Light weight of body, lb.	80,900
Trucks, lb.	28,200
Total light weight, lb.	109,100
Water, fuel, oil, crew, etc., lb.	3,300
Total service weight, lb.	112,400
Revenue load, lb.	15,100
Total loaded weight, lb.	127,500
Seating capacity	34

the revolving type as the car is not turned at the ends of runs.

The side sash in the passenger compartment are double glazed and dehydrated, and the inner glass are shatterproof. The sash in the ends of the car have single shatterproof glass.

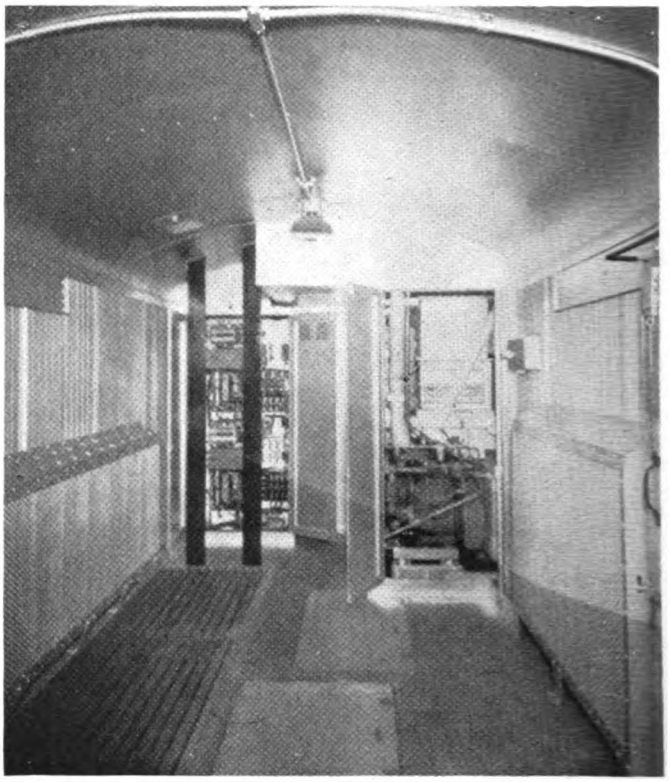
The passenger compartment is lighted by safety center ceiling fixtures which have blue night lights built in, and by individual lights in the safety basket racks over each seat. The floor is covered with carpet. There are venetian blinds at the windows. Drapes cover the piers between the windows. In the passageway between the baggage and passenger compartments is a G. E. water cooler.

The baggage-compartment floor is painted wood, with a small section of fish racks. The side lining is corrugated and the headlining flat. It is equipped with a desk and pigeon-hole case and is lighted by standard center and side-door fixtures.

The American Car and Foundry all-weather air-conditioning and heating equipment has a cooling capacity

Partial List of Equipment on the Missouri Pacific Motorailer

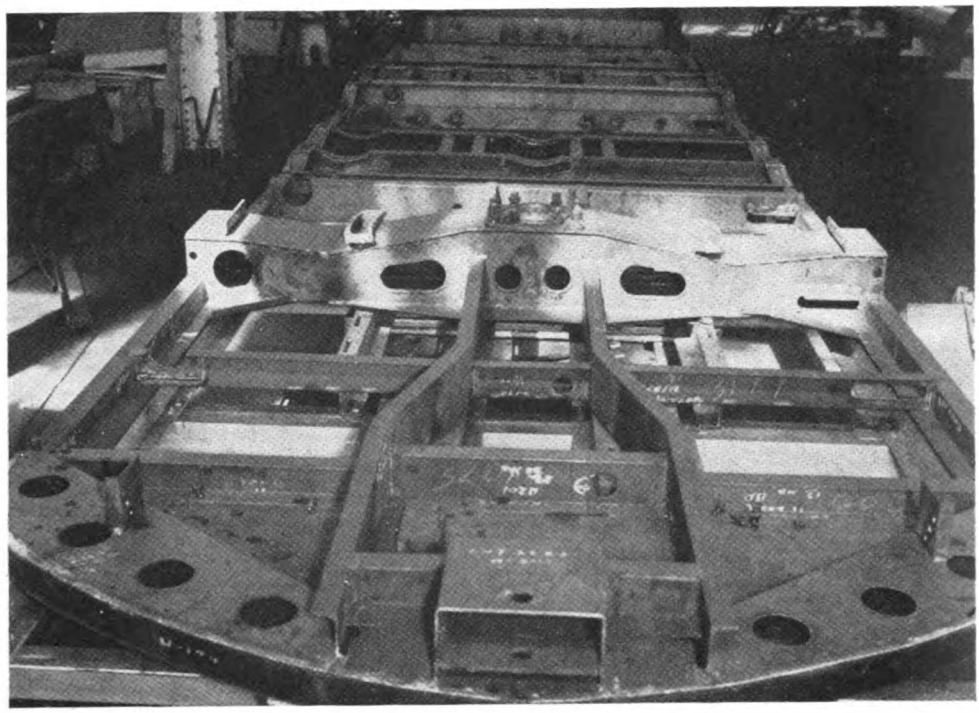
Truck frames	General Steel Castings Corp., Eddystone, Pa.
Journal bearings	The Timken Roller Bearing Co., Canton, O.
Clasp brakes	American Steel Foundries, Chicago
Snubbers	Houde Engineering Corp., Buffalo, N. Y.
Air brakes	Westinghouse Air Brake Co., Wilmerding, Pa.
Propeller shaft	Spicer Mfg. Corp., Toledo, Ohio
Engine	Waukesha Motor Co., Waukesha, Wis.
Torque converter	Twin Disc Clutch Co., Racine, Wis.
Exhaust snubber	Burgess Battery Co., Madison, Wis.
Battery	Electric Storage Battery Company, Philadelphia, Pa.
Radiators	Young Radiator Co., Racine, Wis.
Radiator shutters	Kysor Heater Co., Cadillac, Mich.
Sanders	Graham-White Sander Corp., Roanoke, Va.
Air conditioning	American Car and Foundry Company, New York
Multi-vent panels; headlight.	Pyle-National Co., Chicago
Cooling fans	B. F. Sturtevant Co., Hyde Park, Boston, Mass.
Generators; generator regulators; air compressors; water coolers	General Electric Company, Schenectady, N. Y.
Sash	Adams & Westlake Co., Elkhart, Ind.
Venetian blinds	H. B. Dodge Company, Chicago
Seats	Coach & Car Equipment Co., Chicago
Light fixtures; basket racks	Safety Car Heating and Lighting Co., Inc., New York
Insulation	Gustin-Bacon Mfg. Co., Kansas City, Mo.
Horn	The Leslie Co., Lyndhurst, N. J.



Looking toward the rear of the baggage room—The locker on the right houses the air-conditioning equipment, including the motor-driven Freon compressor and the condenser unit—In the locker at the left are the electric regulator equipment for the two traction generators and other electric relays and controls



There are rotating seats with individual reclining backs for thirty-four persons



The underside of the Motorailer underframe

of 6½ tons. When heat is required the blower is turned over to push air across coils which are connected to the engine cooling-water system. Cooling air enters the car through Multi-Vent ceiling panels and is taken out through floor ducts in the side walls. During heating the air flow is reversed.

The operator's cabs at each end of the car are completely enclosed. The upper partition of the side, rear, and door of each cab is glass.

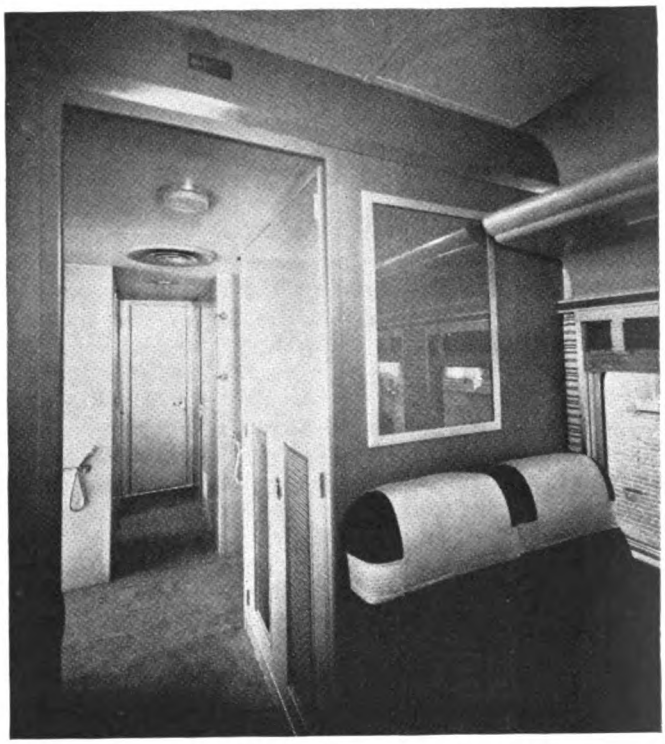
The Car Structure

The car frame is of welded construction with girder-type side frames. The side sills are carried down and under the vestibule step wells. Each side sill is made up of two rolled sections, one assembled in the underframe and the other in its side frame. The two members are riveted together in the final assembly of the body. The side plates are similarly divided between the roof and the side frame. The entire body structure is designed to withstand 100,000 lb. buffing load.

The end construction is all-welded. The main end posts extend through the floor and are secured to the end sill and to the draft sills. The latter extend through the bolster to an adjacent crosstie and are welded to the bolster.

The supports for the power plant extend from side sill to side sill and are arranged to give three-point suspension in rubber insulators to the combined engine and torque converter. Fabreeka insulates the supports from the side sills.

All framing members and sheathing are high-tensile steel.



Looking from the passenger compartment through the vestibule to the corridor between the toilets—The door in the background opens into the baggage room

Power Plant and Transmission

The engines, which are mounted under the floor, are six-cylinder horizontal type with 6¼-in. bore and 6½-in. stroke, spark ignition. Fuel oil is injected solid by a Bosch pump. Compression is low, permitting lightweight moving parts. Each engine is water-cooled by a fan and water-tube radiators. Air is drawn through the radiators from the car side and exhausted under the floor.

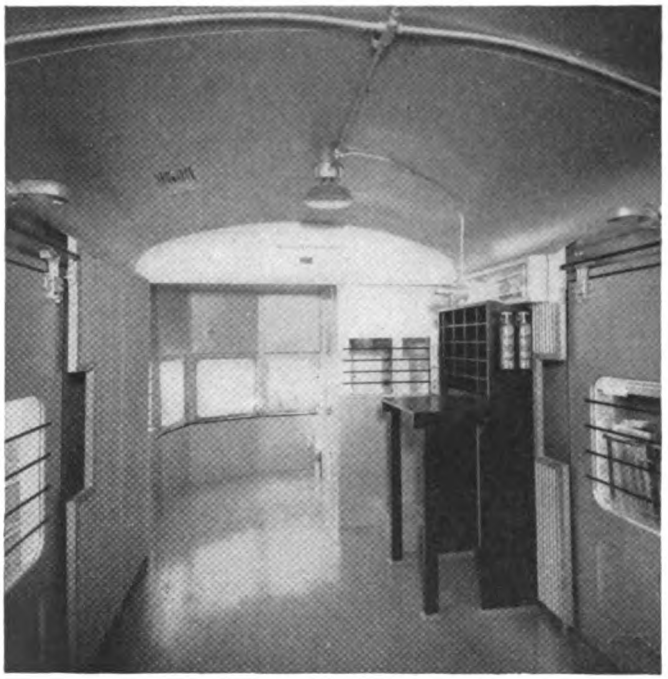
The transmission is a hydraulic torque converter with a direct-drive feature. Hydraulic or direct drive is selected automatically by the master controller which initiates electro-pneumatic shifting of a Twin-Disc clutch. Hydraulic drive is used for starting, accelerating, and extremely heavy grade work. When in direct drive, a free-wheeling unit built into the converter permits the engine to be cut to idling speed without dragging the car speed down.

Power from the converter drives one truck axle by means of a solid, universal-jointed propeller shaft. A pinion on the propeller shaft is constantly in mesh with two bevel gears in the axle housing. Forward or reverse

motion of the car is obtained by locking one of the bevel gears to the axle by means of a splined clutch.

Accessory, control, and lighting power is supplied by two G. E. 20-kw., 125-volt generators, one driven by V-belts from each engine. Each engine also drives a small 12-volt generator to supply power for engine starting, the headlight, and battery charging.

Each engine is protected against over-speed, reverse



The operator's compartment is in the background at the right

operation, high water temperature, and low oil pressure by an automatic fuel shut-off. Graham-White sanders are installed.

Trucks and Brakes

The trucks are the General Steel Castings four-wheel drop-equalizer type with coil springs, Timken roller bearings and Houde snubbers to ease horizontal and vertical bolster motion and nosing of the truck. Insulating pads are installed at several points to deaden rail noise and shock. The A. S. F. clasp brakes are operated by truck-mounted cylinders, one on each side.

The brake system is the Westinghouse straight-air type SME, with deadman control and automatic sanding in emergency. The brake valve is self-lapping.

Railroads Use of Flame-Hardening Processes

(*Continued from page 20*)

rail and were hardened to between 400 and 450 Brinell. This hardness could have been greatly exceeded, but it was felt that 400 Brinell was most satisfactory for the application. Both wing rails and the point were hardened.

A large number of angle bars of various compositions and heat-treatments were hardened in July, 1939. The hardness of the untreated bars ranged from 207 to 235 Brinell. The hardness desired was specified at 400 Brinell, which was easily obtained. The middle 6 in. on the fishing surface was the only area hardened. These bars are still in service on a middle-western railroad and results of the test are being gathered by A. A. R. engineers for study.

The hardening of rail ends to postpone batter is now standard on several railroads.

Various types of gears for work equipment, cranes, and transfer tables, have proved excellent applications for flame-hardening. Two outstanding examples are of particular interest. The first is a driving gear for a pile driver. This gear was flame-cut to size from axle steel and flame-hardened. No machining was necessary on the teeth. The increase in service life has been 500 per cent. The second good example is the gear of a transfer table. This gear is 7⅛-in. pitch diameter, has 15 teeth, with a 4¾-in. face and formerly had to be changed every six months. The flame-hardened gear after 1¾ years of service shows no apparent wear.

Crane wheels make an excellent application for flame-hardening. These generally are made of chilled cast iron. In many instances, replacement of these wheels was found necessary because of broken flanges which could not be repaired. By changing to cast-steel wheels, reclamation by welding is permitted. Since there is no distortion from flame-hardening, such wheels can be machined to size beforehand and can be hardened to 650 Brinell in 12 min.

The hardening application on cast-steel turntable wheels is quite similar to that used on crane wheels. Turntable wheels have been flame-hardened to 500 Brinell in 8 min.

Pressing Dies

It has been the practice to use alloy cast iron for pressing dies used in the manufacture of such car parts as diaphragms and side stakes. The unhardened alloy cast iron can be replaced with the cheaper grey cast iron and flame-hardened. Dies so treated have from 300 to 600 per cent more service life. Furthermore, a flame-hardened die, when worn, can be reclaimed by oxy-acetylene welding, using a cast-iron welding rod and flame-hardening. Dies hardened by this method and then used for pressing material heated to 1,500 to 1,600 deg. F. have pressed over 400 pieces with no apparent wear.

Further Advance Expected

When flame-hardening was first introduced in the steel-treating industry several years ago it immediately demonstrated its advantages. Many manufacturers grasped flame-hardening as a means of lowering costs and increasing production. Many wild and fantastic predictions were made in their enthusiasm and today many of these predictions have come true. The process has advanced to a point where it is possible to evaluate it properly in the light of several years of successful laboratory and practical experience.

A few years ago it would have been impossible to machine a part complete to size and then harden, without distortion, only that portion where hardness was desired. For example, hardening only the teeth of an 8-ft. diameter gear, weighing 8,000 lb., would have been considered an impossibility. Today such jobs are common practice. The flame-hardening process still has many limitations, which are being rapidly overcome by research and experience.

Flame-hardening may never replace all other forms of heat-treating. It may not even equal some of them, but it gives to industry a new tool that will permit the hardening of many parts heretofore considered impracticable.

New York Central's

Manpower Conservation Plans*

By F. K. Mitchell†

Various plans discussed which will add to the available labor supply and its output—Employment of women in increasing numbers—Government agencies can help

MILITARY conflicts, similar to the one in which we are now engaged, are won by that side having the most adequate personnel. Personnel, or manpower, is made adequate by reason of its sufficiency in numbers, training, clothing, material and transportation. This statement applies to the personnel of our armed forces and to the personnel of industry as well. The latter must be maintained even though there is a constant drain to the military services. Transportation, to be adequate, must be capable of handling peak movements of men, both during training and for actual combat, without interruption. It must be able to handle peak movements of raw materials to the factories and munition plants, and shipments of the finished products (clothing, food and material) to the point of consumption. This can only be accomplished by adequate personnel within the transportation industry, of which our rail systems are the heart, the arteries and the veins. These facts were impressed upon us during the first world war. They have since been recognized by military, political, industrial, labor and transportation leaders. That recognition is responsible, in a large measure, for the successes so far achieved.

What the New York Central Has Done

At the outset of this war, or specifically, as of January 1, 1941, the equipment department of the New York Central employed 26,117 men. Of this total, 16,922 were those coming under the classification of "skilled," including mechanics, helpers and apprentices. There were some furloughed employees in all crafts or classifications, but in most instances the number was so few that before many weeks had elapsed those available for recall to service were either non-existent or at least entirely inadequate to meet the demands of a rapidly growing business. When this situation developed, those responsible immediately set about devising and instituting measures designed to improve it.

The action taken was of three general classifications. First, that accomplished through federal and state government-management co-operation; second, that accomplished through management-labor co-operation; and finally, that accomplished primarily through the efforts of management.

In the first group came a closer co-operation with federal hiring agencies. All over the entire system the local representatives of the United States Employment Service and of the Railroad Retirement Board Employment Service were contacted and kept advised of our needs. The possibilities of assistance from them were exhausted before any other channels of employment were used.

In order to improve and make more effective those employees already in service, educational and training programs sponsored by national and state agencies have been instituted. As of November 1, 1942, 1,512 equipment department employees were enrolled in job-instruction courses and 1,411 employees in foremanship training courses sponsored by national and state agencies and universities.

In our endeavor to avoid losing to the draft much needed employees, and still comply with the provisions and intent of the Selective Service Act, we have co-operated both nationally and locally with the officials charged with the administration of that Act. We have asked for deferments only where the Act permitted and circumstances justified such requests. In the main, we have found local and national officials most sympathetic to our needs. On the other hand, certain features of the administration of the Act have affected us adversely.

To help further the national endeavor to solve the railroad manpower problem we have been furnishing a member for the Manpower Advisory Committee of the Office of Defense Transportation and likewise the Regional Mechanical Committee of that same office.

The second group of activities which involved management-labor cooperation has been quite varied. Early it was recognized by both parties that certain provisions in our labor contracts would have to be temporarily waived or amended in order to meet the emergency. One of these affected the possibility of expanding the ranks of our mechanics. Under the contract only mechanics with four years' experience could be hired as such, and only after completing a four-year apprenticeship could a man be made a mechanic. Negotiations between management and labor led to an agreement whereunder apprentices can be advanced to the rank of mechanic after completing two years of their apprenticeship, and helpers with at least two years' experience can be advanced to mechanics. This same understanding also provides how the seniority of men so advanced shall be established. Other understandings made possible an adjustment of certain limitations on hiring ages, some easing of physical requirements for hiring, and the removal from the labor contracts of certain inhibitions as to race and color. Management-labor conferences have likewise been held on questions of securing needed help, reducing absenteeism, wage and working conditions, the employment of females, more intensive participation of employees in safety activities and improved methods of handling controversial matters and avoiding them. These

* A paper delivered before the session of the American Society of Mechanical Engineers sponsored by the Railroad Division at the annual meeting held in New York, November 30-December 4, 1942.

† Assistant general superintendent of motive power and rolling stock, New York Central, New York.

activities have aided our conservation of manpower program very materially.

The third group of manpower conservation activities, conducted primarily on the part of management, have likewise been very effective. Realizing that every hour lost through accident or sickness meant some vital task either left undone or only superficially done, activities along these lines have been ceaseless. Hazards of all sorts are continually being sought and eliminated. Shop safety control boards consisting of workmen and functioning not only as safety committees, but also as judge and jury in safety rule violation cases, have been instituted. Additions have been made to nursing staffs and improved medical attention provided. Supervision and workmen alike have been encouraged to take advantage of Red Cross first-aid instructions, and hundreds have done so. The annual physical examination of supervisors has been made mandatory. Salt tablets have been made available to all during hot weather. Toilet and washroom facilities have been improved where material for such work could be obtained. Ventilation of welding and other shops have been improved by exhausters and fans where these were obtainable, and similar improvements are to be made if and when authorization for the material can be obtained. Certain engine terminals are having stalls lengthened, and shops are being improved in order that men may be better housed during cold weather. Other improvements of the same nature are to be made when authorization can be had for the needed materials.

Trend in Employment in the New York Central Mechanical Department

MECHANICS, HELPERS, AND APPRENTICES

	Total number on payrolls		
	Jan. 1, 1941	Jan. 1, 1942	Oct. 1, 1942
Mechanics	12,170	13,315	14,002
Helpers	4,085	4,584	4,874
Apprentices (regular & helper)	667	763	808
Total	16,922	18,662	19,684

Mechanics added	Jan. 1, 1941-Jan. 1, 1942	Jan. 1, 1942-Oct. 1, 1942
Mechanics hired new	1,581	912
Helpers advanced to mechanics	746	750
Apprentices promoted on completion of course	105	42
Apprentices promoted in advance of completion of course	146	126
Total	2,578	1,830

Mechanics lost		
Mortality	119	86
Retirement	213	99
To military service	54	246
Resignations to accept work elsewhere	522	510
Other causes	525	202
Total	1,433	1,143
Net increase:		
Number	1,145	687
Per cent	9.41	5.16

ALL OTHER EMPLOYEES

	Jan. 1, 1941	Jan. 1, 1942	Oct. 1, 1942
Total number on payrolls	9,195	10,416	11,018

Number added	Jan. 1, 1941-Jan. 1, 1942	Jan. 1, 1942-Oct. 1, 1942
Hired new	5,103	6,620
From other sources	677	523
Total	5,780	7,143

Number lost		
Mortality	88	93
Retirement	128	70
To military service	392	1,368
Resigned to accept work elsewhere	1,896	3,274
Other causes	1,460	1,401
Total	3,964	6,206
Net increase:		
Number	1,816	937
Per cent	13.02	5.95

Assign Work Where Help is Available

In a rail system the size of the New York Central the equipment shopping demand for various parts of the lines is a constantly varying factor. Peak demands in one location occur when ebb demands are occurring in another. The work load must, therefore, be distributed so that production will not lag at any point. Force increases of any consequence cannot be made, hence, the "move the work to the workman" policy has been adopted. Every month, equipment which would normally be shopped at one location is worked to another in order to level off a peak one place and build up the production at another. The necessity for this work equalization exists, not only between shop and shop, but between shop and engine terminal or car repair yard. Such a procedure requires careful planning and foresight, but we have found that if it is properly carried out, no one other factor is of such great value in conserving and making more productive our available manpower.

Personnel Training and Records

The training of personnel has been mentioned previously, in discussion of cooperation with national and state agencies to that end. Training not related to such agencies has been going on apace. Nearly two hundred supervisors are enrolled in a series of foremanship conferences sponsored by management. All tool-room foremen have attended course of study in tool tipping, grinding and design. Welding foremen have had made available to them training courses designed to teach them the latest practices so important to the conservation of materials and manpower. These supervisors are now actively engaged in disseminating the information they obtained through these courses to those who work with and for them. Apprentice training, both in the shop and the classroom, is being carried on. Each of our major shops has an apprentice instructor. Apprentice classroom instruction courses have been revised and modernized. Each apprentice has a sponsor in a supervisory position whose duty it is to aid the boy in every way possible. There are now on our rolls 808 apprentices as compared with 667 as of January 1, 1941.

The final phase of manpower conservation, which to a large extent is new, and now proving to be of great value, is the institution of a more adequate system of personnel records. In the past, personnel was something only the manager of personnel was interested in. Today, it is and should be the concern of every official. It was formerly a record of the past. Today it is a record of the present and a forecast of the future. We now know our mortality rate, our retirement rate, our rate of loss to the military services and to other industry, by localities, and for the entire equipment department. We also know our procurement rate and the number of vacancies by craft and class for the same jurisdictions. We further know exactly how many jobs, by I. C. C. classification and description, we have which can be handled by female employees. From a study of these rates and statistics we believe we have a fair picture of our future needs and some idea of what we can do about it.

There is every indication that an increased traffic demand, coupled with an ever increasing drain of manpower to the military service and to other industries, will make necessary the adoption of other measures.

This is emphasized by the fact that we now have over one thousand authorized positions unfilled.

Will Apprenticeship Dry Up?

In the apprentice situation, which is the key to skilled personnel training, we are caught between two conflicting demands. On one hand we desire to, and the Manpower Commission urges that we keep our apprentice ratio up to that permitted in our labor contracts (one apprentice to each five mechanics). This we have striven to do. But on the other hand, the Selective Service Act says we may ask for deferment only on such apprentices as have had two years' service. While the lower age limit of draftees was 21 years, the employment of apprentices at 18 years of age made it possible to augment our apprentice group by hiring young men of that age, and by the time they were eligible for induction into the armed services they were also eligible for deferment. Now that the age group 18 to 20 are eligible to draft, no such possibility exists. In some states even the hiring of men less than 18 years of age is illegal. Thus, unless some relief is obtained our apprentice procurement will become hopelessly inadequate. It is suggested by way of solving this problem, that an understanding be reached as to what actually is the minimum apprentice ratio required and then that deferment for apprentices be allocated to the railroads in numbers which will produce that ratio. Only by such a means can replacements through apprenticeship be made or the training of skilled employee replacements in adequate numbers be accomplished. Such a decision should be made by representatives of the A.A.R., O.D.T., U.S.E.S., administrators of the Selective Service Act and labor acting as a committee, whose decision would be final and binding. Deferments where the ratio was shown to be less than that figure set by this committee should, with possibly one exception, be mandatory on the part of the local draft boards and refusal of deferment where that ratio is known to already exist should likewise be mandatory. In all fairness, an exception to this rule should be considered. Every organization has within its ranks certain employees who are not properly qualified (and who may never be, either through lack of diligence or natural aptitude) to perform successfully the work for which they are being trained. There is no exception to this among the apprentices in the railroad industry. It would be an injustice to the railroad, to the nation, and such apprentices themselves, for their exemption to be requested. Consideration may well be given, therefore, by labor and management to the perfection of an understanding which will permit waiving of the deferment request where it is agreed that any apprentice has not the qualifications for, nor the aptitude required successfully to be developed into an acceptable mechanic.

It should be recognized that special apprentices (graduate engineers) are also an absolute necessity on the part of any railroad. Heretofore practically no consideration has been given to the deferment of such men. For example, the New York Central has definite need for at least twenty-five such men in training constantly. A year ago there were twenty-one on our rolls. Today there remain seven, and of these, one has been classified 1-A and will be inducted shortly. It is suggested that consideration be given to allocation of deferments for special apprentices by the same group which establishes the apprentice ratio for regular and helper apprentices.

Mechanical Department Jobs Which Can Be Filled by Women

Classification	Number of classes of work	Total number of positions
Machinist (welder)	1	9
Machinist	30	52
Machinist helper	17	46
Boilermaker (welder)	1	10
Boilermaker helper	4	5
Blacksmith helper	2	7
Electrician	4	10
Electrician helper	1	1
Sheet metal worker (welder)	3	8
Sheet metal worker	4	16
Carman (welder and cutter)	2	25
Carman (painter)	3	30
Carman (upholsterer)	4	18
Carman (patternmaker)	1	1
Carman (others)	17	45
Carman helper	20	96
Crane operator	1	19
Oilers	1	3
Car cleaner	1	444
Truck operator	1	15
Janitor	1	11
Laborer (leader)	1	12
Laborer (common)	Various	559
Laborer (engine cleaner)	1	242
Laborer (sand men)	1	20
Laborer (supply men)	1	55
Laborer (water tester)	1	14
Laborer (grease-cup filler)	1	21
Laborer (turntable operator)	1	42
Laborer (material man)	1	13
Laborer (lubricator filler)	1	6
Laborer (engine watchman)	1	2
Total	131	1,857

Suggestions for Future Action

While the results of special agreements between management and labor permitting the promotion of helpers to mechanics and the promotion of apprentices to mechanics after two years' service have been good, the statistics show that the possibilities under those agreements have now been practically exhausted. In many shops and localities all available qualified helpers and two-year apprentices have now been promoted. Furthermore, such action has alarmingly depleted the ranks of the helpers. It now, therefore, seems necessary to go a step further, reopen negotiations and provide a satisfactory plan of further relief. Any such agreement will, to be effective, have to make provision for emergency or temporary seniority. It is a self-evident fact that any skilled or semi-skilled help as may be obtained through such agreements probably will not be needed by the railroad after the emergency is over. It is further apparent that the qualifications of such employees will not be such that they may be expected to be able to fill just any jobs to which normal seniority would entitle them. Consequently, it may be desirable to agree on the specific jobs which may be filled by such temporary or emergency employees for the duration of the war. If that is done some provision will likewise have to be made for the vacating of those jobs by the more skilled regular employees now holding them, and their arbitrary assignment to jobs which they can handle and the emergency employee cannot.

The Hiring of Women

Here, then, female employees enter the picture. There are many jobs on a railroad, other than those formerly recognized as coming within a woman's capabilities, which they can do which are now being done by men who could well do a heavier or more skill-exacting job. A recent check was made of the possibilities in this connection and a tabulation of the positions outside of office work which it is felt could be handled by female employees.

There are a total of at least 1,850 positions where such a possibility exists, and they include 131 different occupations. Through an arrangement of this kind a 6¼ per cent increase in force could be effected. No other known source of manpower, not essential for mili-

tary purposes, could approximate the relief which could be obtained by this means. Hence, it is obligatory that we take advantage of it.

Some features in connection with the employment of females, on work available as described above, will have to be considered. First, as to their seniority standing. Here the answer probably lies in setting them up as "temporary or emergency" employees and handling their seniority and job assignment in a manner already proposed for male employees coming under the same category. Next, some special training in supervision and work assignment of female employees will have to be given. This feature can readily be handled without outside assistance. Then the matter of adequate toilet and washroom facilities will have to be taken care of. A survey of our situation in this connection has already been made and it has been found that except for a very few cases no such facilities exist. In the procurement of the necessary materials for their construction, the assistance of the War Production Board will be needed.

Summary of Needed Actions

Summing up the actions considered necessary to insure the continuance of an adequate manpower procurement the following pertinent suggestions have been made:

1—Allocation of deferments for regular, helper and special apprentices to railroads on the basis of ratios set up by a joint committee of representatives from the A.A.R., O.D.T., U.S.E.S., labor and the Office of Selective Service Administration, under the limitations previously cited.

2—State legislation eliminating the inhibition against hiring men between the ages of 16 and 18, where such statutory inhibitions exist.

3—Job freezing in critical industries, including the railroad industry. In England today, no man or woman can obtain or quit a job in an essential industry without the written permission of the Ministry of Labor. Likewise, no firm can employ or discharge a worker without the consent of that government department. The result is that no one can strike, walk out or be locked out, and no one can lure the employee of another by an offer of higher wages. In Canada similar action has been taken, and in our country, to some extent, it has occurred in the lumber and mining industries.

4—A management-labor agreement permitting the hiring of "temporary" or "emergency" employees, which likewise will settle the seniority question of such employees, and permit their assignment to jobs which they can handle and the re-assignment of present incumbents requiring greater skill to jobs which they can handle and the temporary or emergency employee cannot, it being understood that female employees shall fall in this category.

5—Prompt provision of trained supervision for female employees and likewise adequate facilities for their comfort and toilet needs.

6—A continued effort toward further efficiency in machinery, repair methods, labor saving devices, work load planning, safety, health, personnel training, personnel records and co-operation between management, labor and governmental agencies.

This six-point program, based on our past experience and our conception of future needs, is offered as our best suggestion for the maintenance of adequate manpower. That such a program, or one similar in many respects, is a national railroad need, probably will not be denied. It is felt that if such a program is diligently carried out, not only in the equipment department of the New York Central, but as a national railroad policy, there will be no possibility of failure in this emergency. The manpower problem is not, by any means, the only one facing our transportation systems, yet adequate manpower, in the broader sense, will likewise furnish the answer to most of them.

* * *



Part of 425 uprooted machines and pieces of equipment tagged for scrap in a yard of one of the Pullman-Standard Car Manufacturing Company plants. The dies used by Pullman-Standard in the construction of the first streamline train, The City of Salina of the Union Pacific, have also been scrapped, and equipment which has been stored against possible future needs or for sale and for which actual needs cannot be foreseen is being scrapped

Will Tomorrow's Traffic Require

Diesel or Steam Power?*

By L. K. Sillcox†

A discussion of the several factors involved in the selection of motive power; its operating characteristics and related costs

THE Diesel-electric locomotive has effectively challenged the steam locomotive. True, during the early years of the present century, electrification was introduced and many authorities predicted that the electric locomotive would eventually displace steam power as traffic volume continued to mount. Events of the last few years clearly indicate this is not to be so except in relatively few instances. The use of electric locomotives anticipates the provision of power houses and power lines, feeder lines and trollies to meet maximum demands. The effect of this principle make it impossible to transfer such facilities, or even the locomotives themselves, to points where demands of fluid traffic may require. Electric traction is preferred by many in heavy traffic zones but the Diesel-electric displays identical operating characteristics to the electric locomotive except that its maximum capacity is limited to that of a portable power plant. The line of demarcation between the operating and economic conditions which could be better satisfied by the electric or steam locomotive is more plainly marked than between Diesel-electric and steam power. The case for steam power in sparsely populated territory of easy grades, for example, was very strong. On the other hand, electrification faced no opponents in terminal areas where steam power was excluded by municipal ordinance. This is not true of the Diesel-electric versus steam controversy except in cases where steam is prohibited by legislation. There are many borderline cases and personal preferences. The wide original cost advantage which the steam locomotive has enjoyed over its Diesel-electric counterpart is constantly being narrowed as the cost of steam power increases with refinements designed to increase operating efficiency, and Diesel costs are reduced through standardization and mass production methods. Neither excels to the point of total exclusion of the other. The result is that the evaluation of their merits for a given assignment is more difficult and entails a most exacting study before a logical selection may be made. The Diesel-electric locomotive is an effective compromise between electrification and steam power.

Capital Investment

Because of the more favorable availability characteristics of the Diesel, where it is utilized, a given traffic volume may be moved with a smaller motive power inventory, thereby requiring less capital investment if first costs were comparable. However, the original cost of a Diesel-electric unit is greater than that of its steam competitor, so no clear gain is indicated by the substitution of a reduced number of Diesels for steam power. Steady progress in design and production methods, partially effected by increased production volume, has gradually reduced the initial cost of Diesel locomotives to approximately $87.50 per hp. as contrasted with approximately $35.00 per hp. cost for steam power. Partially offsetting this decided cost advantage of the steam locomotive is the higher availability, and resulting more intensive utilization, possible with Diesel power. The average mileage figures for the competitive types in passenger service are as follows:

Type	Average Annual Mileage	Maximum Monthly Mileage
Diesel-electric	250,000	27,000
Steam	180,000	18,000

In other words, 18 Diesel-electric units will replace 25 steam locomotives of comparable capacity. If the assignment were such that either of the two locomotives whose horsepower characteristics are presented in Fig. 1 could be selected, the 18 Diesel-powered units would require a capital investment more than two and one-half million dollars greater than would the 25 steam-powered units. Lacking experience data, the life of a Diesel locomotive is a matter of conjecture, but it has been tentatively estimated to be 15 years, a value that may be revised upward as experience accumulates. Contrasted is the widely accepted service life of a steam locomotive of 28 years. Annual depreciation charges per installed horsepower are, then, $1.25 and $5.83 for the steam and Diesel types. For the above locomotives, annual depreciation would reach $23,333 for the Diesel while but

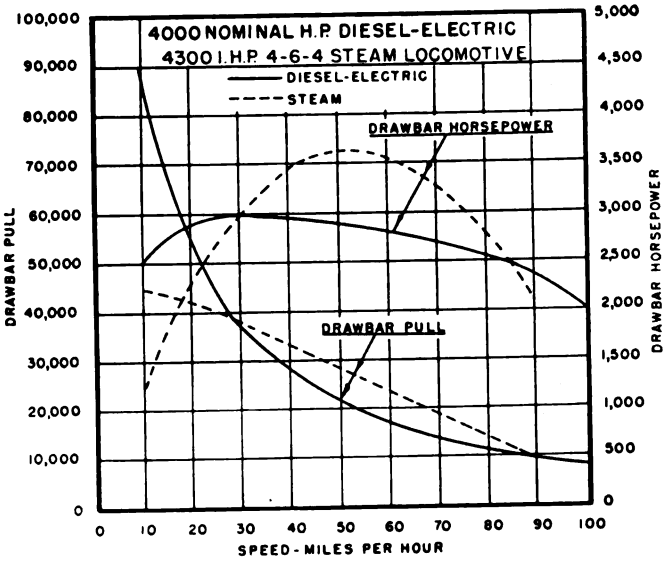


Fig. 1—Comparative drawbar horsepower and drawbar pull curves—Steam vs. Diesel-electric locomotives

* Abstract of a paper prepared for presentation before The Institution of Locomotive Engineers, London, England.

† First vice-president, New York Air Brake Company.

$5,375 would be charged against the steam unit. Competition has encouraged steam locomotive improvements which have forced upward the purchase price while the introduction of mass production methods and adherence to standardization have enabled the Diesel-electric manufacturers to lower their prices. Ten years ago the ratio favoring steam power was four to one, while today it is but two and one-half to one and there is no evidence to indicate that the trend will not continue. Actual initial cost data submitted by one railway is representative of the gains accruing to the Diesel in this account. In 1937, this railway purchased a series of steam locomotives with a 4-8-4 wheel arrangement for which the cost was 25 dollars per hp. Two years later, an order placed for a series, basically similar in design but differing somewhat in details, was billed at a charge of 30 dollars per hp. In 1941, locomotives of the 4-8-8-4 wheel arrangement cost 35 dollars per hp., indicating that the unit cost of steam power is steadily increasing. On the other hand, in 1937 a 5,400-hp. Diesel-electric unit cost the purchaser $104.00 per hp., while in 1941 a similar locomotive developing 6,000 hp. could be obtained at a 90 dollar unit cost.

Depreciation or Obsolescence?

Depreciation rates cannot be determined with strict confidence; for lack of experience data concerning the Diesel, and there is still controversy relative to steam locomotive life, even after over 100 years of accumulated experience. Reference to any railway equipment classification register doubtless will disclose steam locomotive ages of 15 years, 25 years, and even 50 years, although, in the latter case, probably no part of the original locomotive remains, aside from the number. Locomotive components are often replaced a part at a time to perpetuate the machine and this practice is the basis for the "no depreciation account" which has been advocated in some quarters. At first thought, one might be inclined to agree with this extreme view but it is not difficult to discern the fallacy involved, although possibly the term obsolescence should be substituted for depreciation. By proper maintenance, a steam locomotive can be maintained in such degree of mechanical efficiency as to be judged satisfactory when viewed in the light of efficiency standards obtaining at the time of its manufacture and the unit would not have been depreciated to the scrap pile. But advances may be accomplished in locomotive design or, just as important, operating demands may be increased to such extent as to render the locomotive economically unjustified and it is scrapped because of obsolescence.

Water Costs and Consumption

The Diesel-electric, burdened by a disproportionate initial cost, and consequent fixed charges, offers compensating advantages. An example is the lower water costs incurred in the utilization of Diesel power. Water costs as applicable to the steam locomotive are often ten per cent of the fuel charge, a very appreciable item of expense. If a Diesel locomotive is substituted in the same service, this charge will be reduced from ten to one per cent of steam locomotive fuel costs, if it be passenger service where steam generators are utilized for heating or air conditioning, and to a negligible value in freight service where no auxiliary power plant is required. It is difficult to overemphasize the importance of this reduction in water consumption, especially in operating districts where water of proper characteristics or in suitable quantities is not available. Railways operating steam locomotives in such territory resort to the use of auxiliary water cars, thereby increasing costs to a marked degree, in addition to curtailing revenue loading by an amount equivalent to the weight of water car and contents. Diesel power eliminates the necessity for chemically treating large volumes of boiler feed water. Inactive time required for boiler washing, testing, and repair, inherent in the steam locomotive, is not suffered when Diesel-electric power is employed and a higher availability results, a factor in reducing the number of units necessary for a given assignment.

Diesel Flexibility

The greater flexibility of the Diesel locomotive is another attractive characteristic which this power type displays. Since it is possible to operate such units singly, or in associated groups of two or more, centrally controlled, the amount of motive power assigned to a given train can be arbitrarily changed to meet traffic demands. Moreover, during the course of a run, the various units may idle during periods when full power is not needed. While operating on level, tangent track but a portion of the total power available is required to maintain operating speed and during this period one or more units may be idling, whereas on adverse grades, or when accelerating to speed after a slow-down or stop, the full complement of power available may be employed to overcome the greater resistances encountered. During low-demand periods, the various units may be alternately released for inspection and any light service repairs deemed necessary. Thus, maintenance may be accomplished en route with a consequent reduction in terminal delay; affording, at the same time, insurance against the development of defects which, if permitted to persist, may lead to damage of serious proportions entailing delay in terminals awaiting repairs at a high expense penalty.

When a complete failure of a steam locomotive occurs, the train is helpless until an additional locomotive is despatched to bring the train in. Rarely does a multiple unit Diesel locomotive fail completely. The delay is only that arising from the reduction in operating speed caused by insufficient power. The steam locomotive is at a distinct disadvantage because of its inability to present this same characteristic of flexibility.

Lateral Thrust Versus Dynamic Augment

Engineering officers, while realizing the importance of the lateral thrust developed with the swivel trucks used on Diesel motive power in conjunction with high concentrated loads on small wheels, nevertheless praise the Diesel-electric for its lack of overbalance, inherent in the conventional reciprocating steam locomotive. Differences of opinion obtain with regard to track effects in the case of locomotives having low centers of gravity such as the Diesel-electric or of the dynamic augment produced by the overbalance in the steam locomotive. The dynamic augment varies with the square of the speed and produces serious limitations to steam power in the high-speed zone. If a locomotive encounters a section of poor rail, in so far as adhesive condition is concerned when it is being operated near capacity, driving wheel slipping may occur, thus developing high rotative speed in consequence of which elevated track stresses result.

Efforts to improve this condition have included the reduction in weight of reciprocating parts by the substitution of lightweight, high-tensile, alloy steels. By increasing the number of cylinders to four, thereby providing two sets of reciprocating motion, as has been done in articulated designs, unit reciprocating weights have been reduced and the condition improved. The trend

toward ever larger locomotives has been reflected in massive reciprocating parts and has, therefore, increased the difficulties suffered from dynamic augment. The articulated design replaces the large engine by a multiplicity of smaller ones to do the same work. One locomotive has been constructed in which complete freedom from overbalance has been obtained by employing individual axle drive. If maintenance and other operative characteristics prove satisfactory, this design offers possibilities for high-speed operation.

Steam Locomotive Performance

A striking example of what can be accomplished when all components affecting operating results are intelligently administered and energetically policed is that of the Norfolk & Western. In 1925 the N. & W. handled 27 billion gross ton miles with 653 road locomotives while, in 1940, this same road handled 30 billion gross ton miles with 347 road locomotives. In 1925 gross ton miles per train hour were 32,212 but by 1940 this figure had increased to 57,984. The improved boiler efficiency is demonstrated by the reduction in unit fuel consumption. The coal consumed per thousand gross ton miles decreased from 147 lb. in 1925 to 89 in 1940. Improved dependability is evidenced by the reduction of freight locomotive failures from 388 to 74. At the same time, miles per freight locomotive failure more than tripled.

Table I—Comparison of Freight Locomotive Data—1925 and 1940—Norfolk and Western Railway

Account	Years 1925	Years 1940	Change, Per Cent + Increase – Decrease
Gross earnings	$105,218,991	$105,228,621	+0.009
Net earnings	26,565,292	31,383,976	+18
Gross ton-miles (thousands) (excl. loco. and tender)	27,037,267	30,178,450	+12
No. loco's. used	653	347	–47
Avg. tractive force—lb.	60,653	88,947	+47
Gross ton-miles per frt. train-mile (excl. loco. and tender)	2,613	3,805	+46
Avg. speed—train-miles per train-hour	12.3	15.4	+25
Gross ton-miles per train-hour (excl. loco. and tender)	32,212	57,984	+80
Lb. coal per 1,000 gross ton-miles (inc. loco. and tender)	147	89	–39
No. loco. failures	388	74	–81
Miles per failure	34,892	114,970	+230
Cost of loco. repairs per million tractive-force lb.-miles	$7.35	$4.99	–32

Many have maintained that the added refinements and auxiliaries built into modern steam power would measurably increase maintenance costs. This is not true in the case of the Norfolk & Western. On the basis of 1,000 gross ton miles, the maintenance costs in 1925 was 31.2 cents, while in 1940 it was 16 cents. The cumulative effect of these savings is reflected in the net earnings account where an 18 per cent increase is indicated with gross earnings for the two years remaining unchanged. The detailed statistics are shown in Table I.

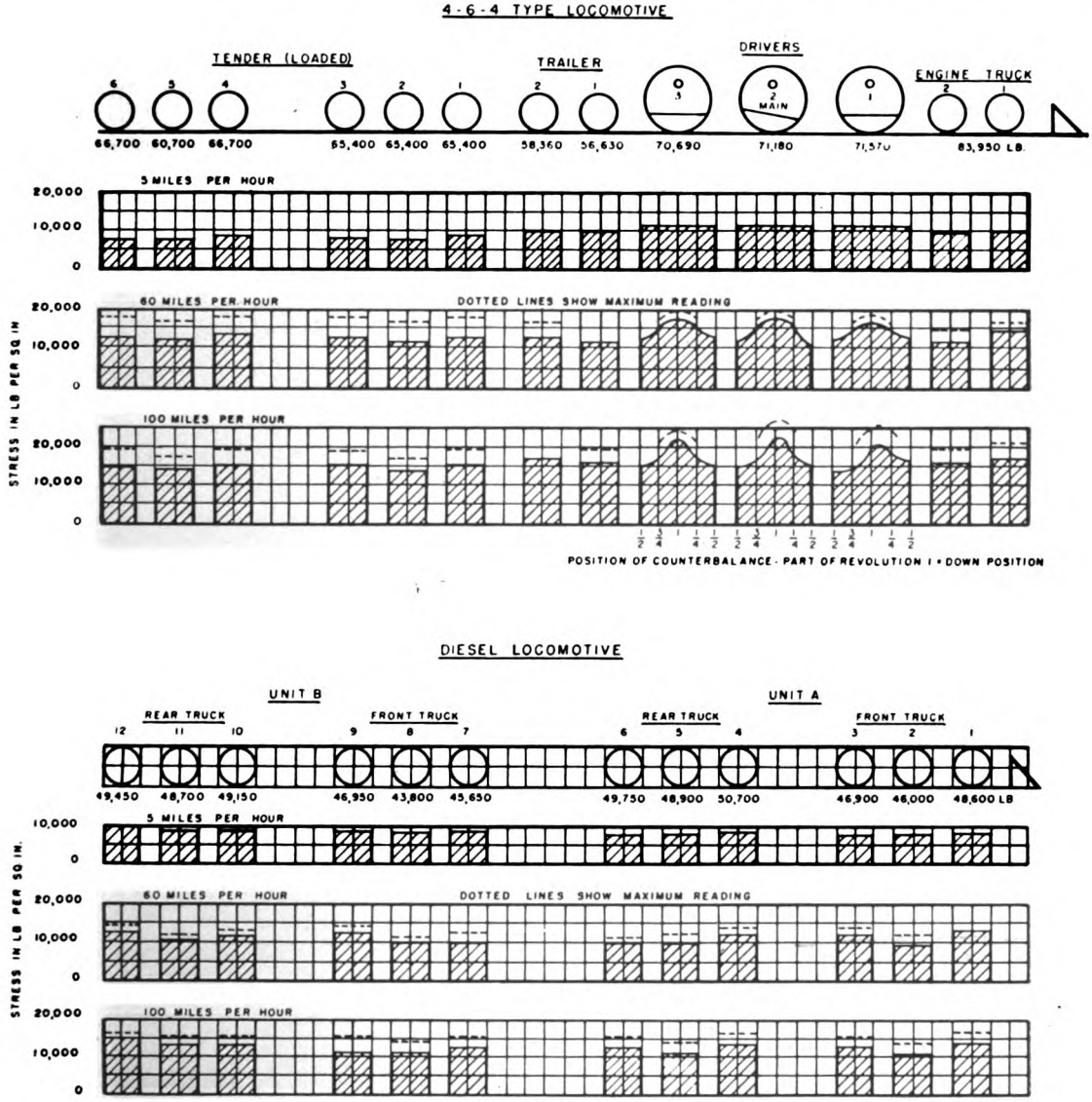


Fig. 2—Comparison of vertical stresses at base of rail; tangent track—110-lb. rail

Fig. 3 presents a comparison of the performance of a steam locomotive of 4-6-4 wheel arrangement and a 4,000-hp. Diesel-electric unit when operating over the same territory. These two locomotives are assigned to identical services and produce approximately the same amount of effort during the course of a run, the exception being that, when necessary, the Diesel-electric can maintain on-time performance with a heavier train.

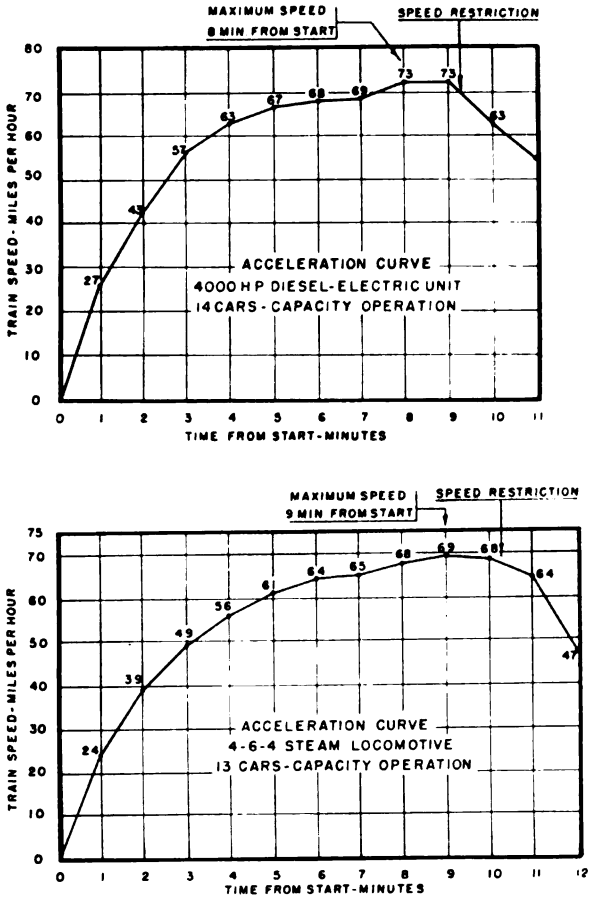


Fig. 3—Comparative acceleration curves—Capacity operation—Steam vs. Diesel-electric locomotives

It might be argued by steam power proponents that this is not a true comparison and that other steam locomotives of the same wheel arrangement can surpass the capacity exhibited by the Diesel-electric unit. The reply in this case is that each of the locomotives is of the most modern design and the characteristics installed were selected as the best obtainable with the power type for the service to which they are assigned.

Comparative driver horsepower and tractive force curves are presented in Fig. 4 of a steam locomotive which develops, at a maximum, 5,000 cylinder hp. and of a Diesel-electric rated at 5,400 hp. These curves may be compared with those of the two motive power types as illustrated in Fig. 1. It will be noted that, in Fig. 1, the plotted values are taken at the drawbar, hence the effect of the difference in weight of the two units is reflected through the medium of locomotive resistance. These two sets of curves demonstrate clearly the superior power characteristics of the Diesel-electric throughout the low-speed range below approximately 30 m. p. h. and at once explain the greater accelerating capacity of this motive-power type. They also provide an explanation for the improved acceleration characteristics of the Diesel as graphically presented in Fig. 3.

Inasmuch as most switching operations are made in the low-speed range where the Diesel's excess tractive capacity may be utilized, the steam locomotive is at a decided competitive disadvantage. The Diesel is almost universally displacing steam power when new units are necessary or judged economical. Fig. 5 demonstrates the characteristics of six switching locomotives. For all switching speeds up to 6 m. p. h., the 1,200 hp. Diesel, Class A, delivers higher torque and thus can accelerate maximum tonnage more rapidly than can a steam locomotive of 2,100 hp. Its superiority over a steam locomotive of 1,500 hp. extends to 7 m. p. h., and in comparison with the 1,300 hp. steam locomotive, the Class A Diesel excels at all speeds up to 11 m. p. h. Since most switching operations are conducted at speeds below 6 m. p. h., the Diesel enjoys a definite advantage over its steam counterpart. Installation of the proper gear ratio between traction motor and power axle will enable a Diesel-electric switching locomotive to perform the assignments of a steam locomotive which has a horsepower rating of approximately two and one-half times that of the Diesel.

The favorable availability of the Diesel is attained, in part, by virtue of its characteristic which permits power to be cut off or on momentarily, thus eliminating any delay prior or subsequent to a servicing or maintenance operation. Fueling of the Diesel is required but two or three times per week and offers no serious problem. General overhaul, a yearly maintenance expense, requires from 10 days to two weeks, on the average, of non-productive time, permitting a maximum availability of approximately 95 per cent. On the other hand, a steam locomotive is ordinarily assigned to no more than 16 hours continuous duty a day, it then being relieved for servicing and maintenance. It must be withdrawn from service at 30-day intervals for boiler inspection and washing. Six thousand hours per year of the 8,760 possible, an availability of approximately 68 per cent, is deemed to be as much productive time as may be obtained from a steam powered unit.

Investment Comparsion

On the basis of the foregoing representative availability values, five Diesel switchers will replace seven steam locomotives. Diesels of 600 hp. have regularly performed the yard operations of a 1,400 hp. steam design. With Diesel power costing $87.50 per hp. and steam locomotives, $35.00 per hp., capital investment for the two alternatives would be:

Diesel: Five 600-hp. units at $87.50 = 5 × 600 × 87.50 = $262,500.

Table II—Displacement Ratio of Steam and Diesel Locomotives

No. of Steam Locomotives	No. of Diesel Locomotives	Ratio—Steam to Diesel
7	5	1.40*
17	12	1.42
32	23	1.39
8	6	1.33
1	1	1.00

* Calculated—based upon availabilities of 68 and 95 per cent for steam and Diesel power, respectively.

Steam: Seven 1,400-hp. units at $35.00 per = 7 × 1,400 × 35 = $343,000.

This condition does not hold for road power, however, due to the higher operating speeds and the Diesel investment is invariably greater than that required for steam. Neither does it hold in yard service if motive power inventory is insufficient to support the five to seven advantage displayed by the Diesel. Table II illustrates this point.

Approximately four years ago, a committee, composed of representatives of one railway and two Diesel-electric switching locomotive manufacturers, was organized for the purpose of determining impartially the relative operating costs of steam and Diesel power in yard service. After thorough and painstaking analysis of available cost data, this committee concluded that, including fuel, lubricants, water supply, enginehouse expenses, and crew wages, the cost per hour of operating a 600-hp. Diesel switcher was $2.68 while the similar cost, if a steam locomotive were selected for the same assignment, would be $3.90, or a difference in favor of the former of $1.22. A further credit of eight cents per hour was agreed upon for savings in locomotive crew overtime and hostlers' wages, with a resulting figure favorable to the Diesel of $1.30 per hour operated. The saving of eight cents per hour labor charge is dependent upon local conditions and is, therefore, subject to considerable variation. The preceding estimate is recorded as of interest in light of actual switching locomotive costs as submitted by three railways. Unfortunately, all railways do not adhere to a uniform accounting system, a fact which must be borne in mind when comparing such data. It will be noted by reference to Table III that Diesel switching locomotive hourly costs are less in all accounts with the exception of the relatively small lubrication expense where it is 50 per cent greater than the amount chargeable to the steam locomotive, and that the total saving per hour approximates $1.75.

A reduction in the cost advantage displayed by the Diesel is evidenced in each instance and a further reduction would be indicated if taxes, insurance, and interest were included. Even then, however, the Diesel would exhibit marked superiority and its retention in service would be economically justified. The steam freight locomotives in Table IV are of modern design, being built in 1938, and are comparable with the Diesel-electric power. The two classes of power are not, however, operated over the same territory and, because of local conditions, the steam locomotives do not handle as heavy trains as do the Diesel-electrics. The tonnage rating of the steam locomotives on a 1.27 per cent ruling grade is 3,200; of the 5,400-hp. Diesels with a 61/16 gear ratio the tonnage rating is 3,500 and, with a gear ratio of 62/15, the

Table III—Hourly Switching Locomotive Costs

	Steam	Diesel	Diesel Saving
Railway A—600 hp. Diesels			
Fuel	$0.801	$0.224	$0.577
Water and other supplies	0.165	0.005	0.160
Lubricants	0.026	0.040	-0.014
Enginehouse expense	0.393	0.038	0.355
Repairs	0.950	0.277	0.673
Total	$2.335	$0.584	$1.751
Railway B—600 and 1,000 hp. Diesels			
Fuel	$1.12	$0.37	$0.75
Water, lubricants and other supplies	0.20	0.08	0.12
Enginehouse expense	0.47	0.04	0.43
Repairs	1.31	0.43	0.88
Total	$3.10	$0.92	$2.18
Railway C—1,000 hp. Diesels			
Fuel	$1.0636	$0.3267	$0.7369
Water, lubricants and other supplies	0.1111	0.0254	0.0857
Enginehouse expense	0.2279	0.0427	0.1852
Repairs	1.0633	0.5500	0.5133
Total	$2.4659	$0.9448	$1.5211
Railway B—600 and 1,000 hp. Diesels			
Fuel	$1.12	$0.37	$0.75
Water, lubrication and other supplies	0.20	0.08	0.12
Enginehouse expense	0.47	0.04	0.43
Repairs	1.31	0.43	0.88
Wages of enginemen	1.82	1.91	-0.09
Depreciation	0.23	0.55	-0.32
Total	$5.15	$3.38	$1.77
Railway C—1,000 hp. Diesels			
Fuel	$1.0636	$0.3267	$0.7369
Water, lubrication and other supplies	0.1111	0.0254	0.0857
Enginehouse expense	0.2279	0.0427	0.1852
Repairs	1.0633	0.5500	0.5133
Wages of enginemen	1.7813	1.7513	0.0300
Depreciation	0.1319	0.4157	-0.2838
Total	$4.3791	$3.1118	$1.2673

To this can be added a comparison of total costs per hour, less taxes, insurance, and interest, based upon the operations of Railways B and C.

Table IV—Freight Locomotive Operating Data

	Steam	Diesel	Diesel Saving
Mileage	455,216	216,725	.....
Availability—per cent	75	90	.....
Utilization—per cent	36	62	.....
Car miles per train-mile	82.5	89.3	.....
Gross ton-miles per tr.-mi.	3,400	3,801	.....
Gross ton-miles per tr.-hr.	92,303	107,940	.....
Train-miles per hour	27.15	28.39	.....
Average number loco. in service	10	3	.....
Average cost per loco.	$174,000	$490,000	.....
Date built	1938	1941	.....
Per Mile Costs			
Repairs	$0.30	$0.23	$0.07
Depreciation	0.08	0.20	-0.12
Fuel	0.33	0.28	0.05
Lubricants	0.01	0.05	-0.04
Water and other supplies	0.05	0.002	0.048
Enginehouse expense	0.04	0.01	0.03
Wages of enginemen	0.18	0.15	0.03
Total cost per loco.-mile	$0.99	$0.922	$0.068
Total cost per thousand gross-ton miles	$0.2908	$0.2254	$0.0654

Table V—Passenger Locomotive Operating Data (January to October, 1941, inclusive)

	Steam	Diesel	Diesel Saving
Mileage	2,212,872	1,813,522	.....
Availability—per cent	75	90	.....
Utilization—per cent	53	90	.....
Average number of locomotives in service	17	7	.....
Average cost per locomotive	$179,000	$365,000	.....
Date built	1938	1936-1941	.....
Per Mile Costs			
Repairs	$0.19	$0.16	$0.03
Depreciation	0.04	0.10	-0.06
Fuel	0.17	0.10	0.07
Lubricants	0.02	0.02	.....
Water and other supplies	0.02	0.008	0.012
Enginehouse expense	0.02	0.012	0.008
Wages of enginemen	0.15	0.12	0.03
Total cost per locomotive-mile	$0.61	$0.52	$0.09

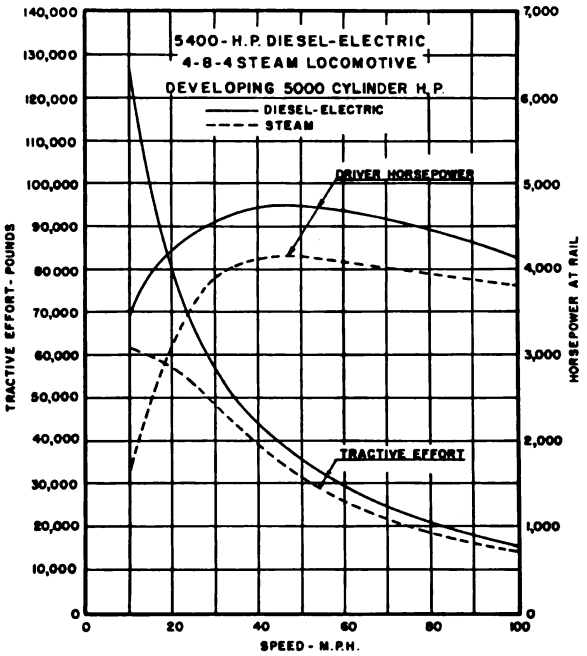


Fig. 4—Comparative driver horsepower and tractive force curves—Steam vs. Diesel-electric locomotives

rating is increased to 3,800. These tonnage ratings are based upon handling trains without helper service. As of possible interest, the effect of varying the gear ratio of these Diesels on tonnage rating with a ruling grade of 2.2 per cent when operating without helper service, and on maximum speed is injected here:

Gear Ratio	Tonnage rating	Maximum speed, m.p.h.,
59/18	1,700	80
61/16	2,000	70
62/15	2,300	65

The administration of the railway operating these locomotives judges a maximum speed of 65 m. p. h. to be ample for freight service and will, therefore, specify the 62/15 gear ratio on future orders so that the extra tonnage may be handled.

In analyzing the operating costs of the Diesel-electric passenger locomotive as compared with the steam locomotive, shown in Table V, allowance should be made for the fact that the Diesels are operated in high-speed service while the steam locomotives are handling heavy

Table VI—Total Costs of Operating Passenger Trains

	Steam	Diesel	Total Diesel Saving
Train-miles operated	325,378	237,626	.....
Locomotive miles, including helper service and double heading	385,637	252,129	.....
Locomotive miles per train-mile	1.185	1.062	.....
Locomotive and train wages	$85,298	$65,254	$20,044
Fuel	65,775	40,162	25,613
Water, lubricants, and supplies	9,081	8,437	644
Train supplies and expenses	41,538	41,538	.....
Helper and double heading	38,054	12,713	25,341
Car repairs	38,679	38,679	.....
Locomotive repairs	90,462	49,901	40,561
Third man on Diesel	.....	8,316	–8,316
Total train	$368,887	$265,000	$103,887
Total locomotive (inc. train wages)	$288,670	$184,783	$103,887

trains at lower rates of speed; consequently, if the steam locomotives were required to operate at the same speeds as the Diesels, even though they were handling light trains, the fuel and repair costs would increase. The passenger train and locomotive costs in Tables VI and VII were submitted by another railway as being applicable to sections of its system over which steam and Diesel-electric locomotives operate in comparable service.

Caution must be exercised when comparing the total costs and savings resulting from Diesel operation, as com-

Table VII—Locomotive Expenses per Train Mile (Including train wages)

	Steam	Diesel	Diesel Saving
Locomotive and train wages	$0.262	$0.275	–$0.013
Fuel	0.202	0.169	0.033
Water, lubricants, and supplies	0.028	0.0355	–0.0075
Helper and doubleheading	0.117	0.0535	0.0635
Locomotive repairs	0.279	0.210	0.069
Third man on Diesel	...	0.035	–0.035
Total	$0.888	$0.778	$0.110
Total train-cost per train-mile	$1.14	$1.12	$0.02
Total locomotive-cost per train-mile	0.89	0.78	0.11
Total locomotive-cost per locomotive-mile	0.75	0.735	0.015

puted by the two railways, inasmuch as one includes a depreciation charge while the other lists expense arising from helper service, doubleheading, and the practice of maintaining a third employee on the Diesel-electric unit. Comparison can only be made between the individual accounts.

The Diesel displays unquestionable advantages for yard assignments, is peculiarly adapted to certain high-speed passenger operations, and is being installed in freight service to a limited extent. The controversy as to steam or Diesel will be finally decided on strict economic principles. Ultimate selection depends, to a large extent, upon the ability of Diesel-electric manufacturers to offer their product at a price comparable with that of the steam locomotive. Should this be accomplished, the position of steam as the motive medium would be precarious.

The substitution of Diesel power would enable the elimination of costly boiler-water preparation facilities, water-service towers or track pans and of unsightly coaling plants. It would remove the necessity for engine-house properties as we know them which could be replaced with modern, attractive maintenance plants.

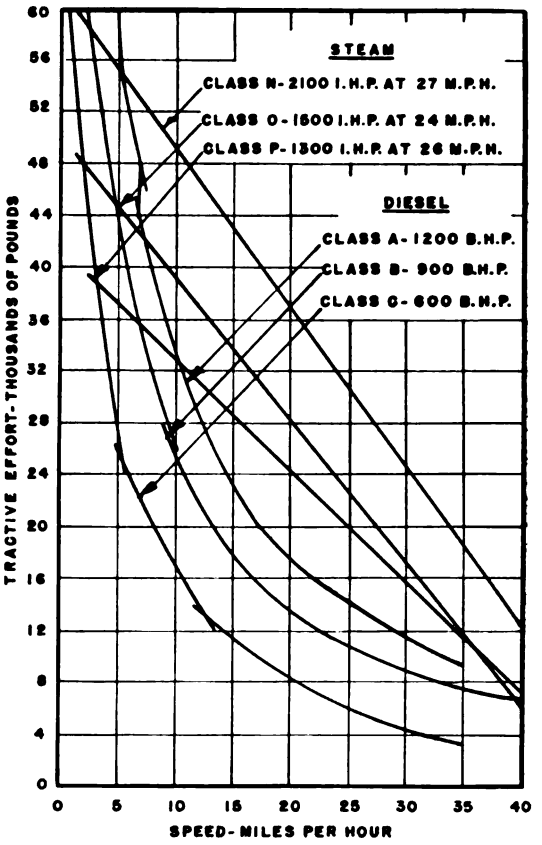


Fig. 5—Switching and transfer locomotive comparisons—Steam vs. Diesel

Diesels would operate to reduce the number of terminals required and to this extent would largely effect an overall improvement in railway operating practice, both with respect to the economy of movement and to the despatch with which tonnage is handled. *Perhaps this is the important aspect of the entire problem of railway modernization made possible through the use of the Diesel; the aspect that should be emphasized more than all others, thus eliminating excuses to stop trains in transit unnecessarily.** Further, if the practice of handling traffic in train-load lots is forced upon the railways by competitive rate situations effected through other forms of transport attempting to obtain the traffic, it merely signifies that railway raffic will represent unit movements covering great distances between originating and final terminals with no intermediate attention affecting train consist required. Railways have but one future; namely, to handle traffic at wholesale rates and to discontinue conditioning rates upon a retail basis.

* The italics are ours.—Editor.

EDITORIALS

Our New Electrical Department

This issue of *Railway Mechanical Engineer* presents you with a newly created electrical department. The innovation is in fact a consolidation of this paper with our former sister publication, Railway Electrical Engineer, which has served electrical men in the railroad field for the past thirty-three years. Our electrical editorial staff has been kept intact and it will now serve the interests of that large majority of electrical men who are in the mechanical department, and the mechanical men who are interested in electrical subjects will no longer need to subscribe to two publications. Similarly, the electrical men who formerly subscribed to Railway Electrical Engineer will find in the *Railway Mechanical Engineer* the kind of articles they have been accustomed to reading and also other information which will keep them in touch with the broader aspects of work being done by the mechanical department.

Under the title "Electrical Leads" (page 50 of this issue) is material intended particularly for the electrical man. This includes the "Consulting Department," with questions and answers on pertinnent current subjects. Among the "New Devices" will be found several which are essentially electrical. In the news pages there are items which specifically concern the electrical readers.

The contents and layout of future numbers may vary from issue to issue, but there will always be a fund of material for the electrical man. Also those articles in the body of the paper which concern such subjects as locomotives (electric, Diesel-electric and steam), shop facilities, air-conditioned and electrically lighted cars, will appear with more complete information on electrical equipment than was formerly supplied in the pages of *Railway Mechanical Engineer.* We look forward to serving our readers and the railroads even more effectively than we have in the past.

"The Last Straw"

The old saying about the last straw being the one which breaks a camel's back has a parallel in the railway transportation field in the demonstrated fact that the last car on an overloaded Diesel-locomotive-driven railway train is the one which causes the trouble. Not only is the excess weight involved important, but the time element must be considered, as the overload capacity of both the Diesel engine and the electric transmission machinery is absolutely dependent upon how long the load must be carried.

Rather definitely limited load capacity is a recognized characteristic of any internal combustion engine-driven equipment, including Diesel locomotives, and railroads must fully recognize this limitation in order to get the best results from the remarkably efficient and effective new tool which has been developed and is offered to them in the form of Diesel motive power. Energetic and often somewhat hard-fisted railway superintendents and other operating officers will do well to remember that because a Diesel locomotive handles a full load on a tough run one day, the addition of another car the following day is not always the best way to increase ton-mileage and get trains over the road.

This point may be emphasized by another homely illustration of what happened in the case of a farm-machinery dealer who sold a small gas-engine-driven tractor to a farmer with the guarantee that it would pull either a one- or two-disc plow in any kind of ground, day in and day out, with no mechanical trouble. After a short test, the farmer returned much pleased to report that the tractor was even better than specified and could, in fact, pull a three-disc plow. The dealer advised strongly against this practice and, when pressed for a reason, said to the farmer, "Do you see that building over there about 200 yards away? How many times could you walk there and back in a day?" The farmer said he didn't know, but could probably keep going about all day. The dealer asked, "How many times could you go at a dog trot?" The answer was again indefinite, but indicated that certainly far fewer round trips could be made than at a walk. Again the dealer asked, "How many times could you go running at top speed?" The farmer replied "H——, I probably couldn't get there once!" The dealer said, "Alright, don't put the third disc on that plow, or if you do, bring your check book the next time you call, for my company refuses to be responsible for what happens to the tractor."

The sequel of this reportedly true story is that the farmer didn't believe the dealer. He put the third disc on the plow; hauled it successfully for only a week; and reappeared at the dealer's office with a sheepish expression on his face and—a check book in his hand. The moral of the story is not hard to find. Unless railroads are willing to pay the price in unnecessary replacement and repair expense, train delays and motive power out of service, they will not overload their Diesel locomotives. It is far better, especially for railroads having little experience with Diesel motive power, to adopt the conservative ratings specified by manufacturers who know what the equipment will do and have a definite incentive to see that it gives satisfactory service over a more or less extensive period of time.

In connection with the subject of rating Diesel locomotives, it is interesting to note that a sub-committee of the American Society of Mechanical Engineers, Railroad Division, has developed the preliminary draft of a test code to establish the continuous and intermittent ratings of Diesel motive power and this code, after being checked

by the Association of American Railroads, Mechanical Division, and the A. S. M. E. Power Code Committee, will doubtless offer railroads a more scientific and practicable method of determining just how heavily Diesel locomotives should be loaded for best results on a long-time basis. The preparation of such a test code to determine Diesel locomotive ratings will fill a long felt want and help railroads meet the motive power situation which confronts them in 1943.

Can Locomotive Repair Costs Be Compared?

Railroad mechanical men have, for years, sought a basis upon which to compare the cost of repairing locomotives. The effort to determine such a basis of comparison has been inspired by a variety of reasons. Some students of this question have felt that if an equitable basis of cost comparison could be arrived at it would be a valuable help in relating the maintenance experience to the problem of design with the result that design would improve to such an extent that maintenance cost would automatically be lowered. Others have approached the question with the idea that locomotive repair cost is a reflection of the efficiency of the organization and facilities with which the repair job is done. Such being the case repair cost data could be used as a measuring stick to compare the performance of one shop with another—either on the same road or on different roads.

Those who have made a study of motive-power repair costs have usually arrived rather early in the study at a point where, in their own minds, there is serious doubt as to the value of the commonly used locomotive-mile basis of expressing cost. Such doubt having arisen, it is natural to give consideration to what is hoped will serve as a more accurate indicator.

If consideration is given to the fact that the job of repairing a locomotive is not necessarily one of restoring that locomotive to a mechanical condition such as existed at some previous shopping period, but rather is one of conditioning it to render a given number of miles of road service, the question of repair cost may appear in a somewhat different light. A locomotive, on most roads at least, is not a machine that is rebuilt in kind as it passes through the shop for repairs but is an assembly of many parts, or groups of parts that by themselves may or may not be rebuilt in kind at that particular shopping, depending on whether or not, in the opinion of a supervisor or inspector, the parts will continue to function satisfactorily until the next assigned period of mileage has been run out.

If the person studying this question were to break down a locomotive into important groups of assemblies and parts and then secure the necessary data to determine the mileage life of these groups together with the cost of their repairs, it would soon be discovered that two locomotives of identical wheel arrangement and tractive force, though of different design as to major parts and special equipment, would show a difference in repair cost even though operated side by side in the same service and accumulating the same number of miles per month. Conversely, two locomotives identical as to wheel arrangement, tractive force and general design and equipment, but operated the same number of miles per month over divisions of the same railroad having different physical or operating characteristics, would show a difference in repair cost.

Like so many other problems involved in railroad operation, this one of locomotive repair costs lends itself to the possibility of many solutions each varying somewhat in direct relation to the fluctuations in the many factors that have a bearing on the ultimate result. It is possible to have equality in the dollar value of total repair expense and have a wide fluctuation in locomotive mileage between two periods of time. The result will be a difference in the repair cost per mile. One road, likewise, may burn its locomotive fuel just as efficiently as another road but have traffic of a character that produces a high gross ton-mile figure. Of two such roads one will show a fuel performance in pounds per thousand gross ton-miles that will be distinctly more favorable than the other road.

In all of this search for detailed and accurate cost data relating to railroad operation it is always worth while to keep in sight the ultimate objective. It may be true that the cost of locomotive repairs per locomotive-mile is not an accurate indicator of the relative efficiency of the men and facilities used for repair work, but it may be a reasonably accurate basis of comparing the cost of restoring serviceable locomotive miles. The average per-mile cost, compared with some previous operating period gives the mechanical man a fair idea as to how well he is holding up his end of the job.

Nine and a Half Million Men Under Arms

Present military plans of the United States contemplate armed forces (all branches) of 9.5 million men at the end of 1943. This will draw heavily on the nation's total labor force as the year progresses.

A study of manpower requirements to fulfill this plan and of the sources from which the labor force is to be recruited was made by The Brookings Institution during 1942. This study assumed an increase in the armed forces during 1943 of 3.8 million men to bring the total up to 7.9 million during the year and indicated a possible increase of 3.5 million in the total labor force, including men under arms. With no change in the number of agricultural workers (9.6 million) an increase in non-agricultural workers of 1.2 million to a total of 43.5 million is estimated. This is made possible by the employment of 1.5 million of the 2.7 million workers unemployed during 1942, the addition of 700 thousand from the year's increase in working population, a possible few thousand immigrants from Mexico, the employment of another 800 thousand to be obtained from young people in school and from those now

retired, and about two million homemakers. Projecting the study into 1944, on the assumption that armed forces will reach 9.5 millions by the end of that year, the total labor force is set at 65.1 million, a further increase of 2.9 million over 1943. For this increase reliance is placed on the population increase, a further increase of school children and aged workers equal to that of the preceding year, and another draft on home-workers of 1.3 million; the net effect on non-agricultural workers is an increase to 45 million. The increase in women employed is 3.3 million in two years, which is at least 60 per cent of the non-farm women over 45 years of age who have no young dependent children.

By a progressive reduction in the production of private goods and services from 92 billion dollars in 1942 to 70 billion dollars in 1943 and 60 billion dollars in 1944, and a moderate reduction in government non-war purchases, the study estimates that, with such a labor force, purchases on war accounts might be stepped up from 35 billion dollars last year to 66 billions this year and to 84 billion dollars in 1944. To accomplish this it is estimated that the actual weekly hours worked will have to be increased from the average of 42.5 in 1942 to 48 in 1944, which will involve schedules averaging at least 50 hours a week and would require schedules well beyond 50 hours in some cases.

Figures recently announced by Paul V. McNutt, chairman, War Manpower Commission, indicate requirements somewhat higher than those assumed in The Brookings Institution study. Mr. McNutt's figure for the total labor force for the end of 1943, including armed forces, corresponds closely with the Brookings' figure for 1944.

An article by F. K. Mitchell, assistant general superintendent motive power and rolling stock, New York Central, which appears elsewhere in this issue, presents a thorough-going study of the manpower situation which mechanical departments of the railways are facing and proposes measures to meet the situation. Studies on his own road disclose possibilities for the employment of women to the extent of 6¼ per cent of the total number of employees in the mechanical department. This compares with the increase in women workers estimated by The Brookings Institution of about 7.6 per cent of total of non-agricultural workers.

It is evident that the task facing the United States is one which cannot possibly be accomplished without upsetting customary methods and arrangements throughout industry. With present provisions for the control of manpower, it should be possible for the railroads to secure such deferrments as are necessary to prevent dangerous disruptions of service. To rely on this possibility to the exclusion of all moves to take care of themselves, however, will be inviting disaster for which no one but themselves can be blamed. There seems no way out but the employment of women for some of the jobs which have customarily been considered man's work. Preparations for this change cannot be started too soon.

New Books

THE STEAM LOCOMOTIVE. *By R. P. Johnson, M. E., chief engineer, The Baldwin Locomotive Works. Published by the Simmons-Boardman Publishing Corporation, 30 Church street, New York. 502 pages, illustrated. Cloth bound. Price, $3.50.*

This book contains a wide range of information, including bases for locomotive proportioning, data concerning operation and testing, and an extensive study of motive-power economics. It should be a useful reference for engineers, railway officers whose responsibility includes general supervision of motive-power selection and performance, supervisors interested in locomotive operation, and students of motive-power performance, both young and old. The author makes no claim to the originality of any of the material in the book; much of it was scattered through periodical literature and treatises dealing with restricted aspects of the steam locomotive or its use until he brought it together. There are 26 chapters. Roughly, these may be divided into three groups—those which deal with the locomotive and its performance; those which discuss conditions outside the locomotive affecting its performance, and those on various aspects of motive-power economics. In the second group are chapters on Locomotive Fuels, Water for Boiler Use, and Curves. The chapter on water is a concise treatise on the selection and treatment of boiler feedwater and includes a discussion of caustic-embrittlement phenomena. Particularly worthy of mention are the chapters on High-Speed Trains, Streamlined and Lightweight Trains, and Motive Power for High-Speed Service. The second of these deals effectively with the relative economic value of weight reduction and streamlining under various conditions. In a chapter on Resistance, locomotive streamlining is also discussed. The motive-power chapter, among other phases of the subject, compares the characteristics of steam and Diesel locomotives, including operating costs, as does also the chapter on Motive Power for Switching Service. Three chapters at the end of the book are devoted to motive-power economics. These are The Relation of Locomotive Operating Expense to Net Operating Income; Locomotive Repair Costs, and Economic Life. To leave the book without some reference to the bulk of material which is devoted to the steam locomotive and its operation would throw the scope of its coverage considerably out of focus. The book does not deal with boiler design nor with the design of other details. There are, however, extensive chapters on combustion and evaporation. Chapters in which is included current data not customarily available in handbooks are those on Tractive Force, Horsepower, and Counterbalancing. Generally speaking, in the field of locomotive proportions and performance, it contains much data and information which is directly related to modern practice. The treatment throughout is essentially practical.

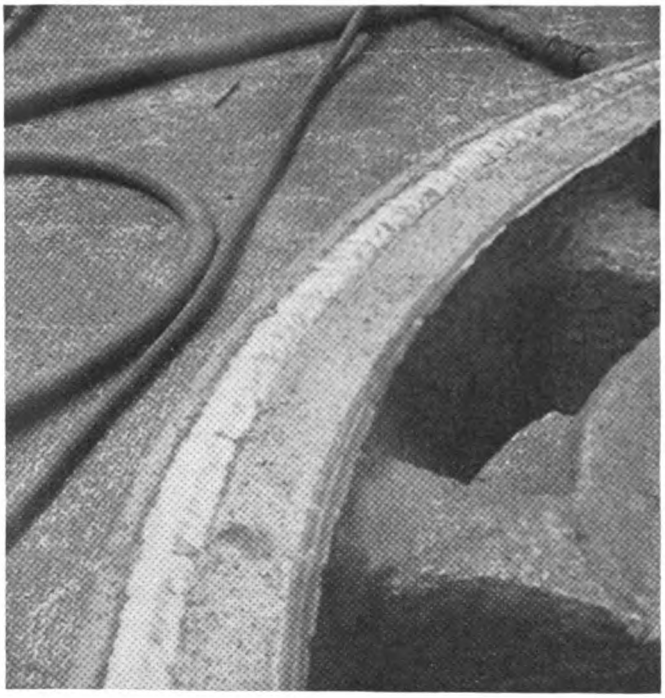
Welding Liners on

Worn Driving-Wheel Centers*

By C. H. Easun†

Canadian National realizes savings in use of one-piece welded liners—Method also proves satisfactory from operating standpoint

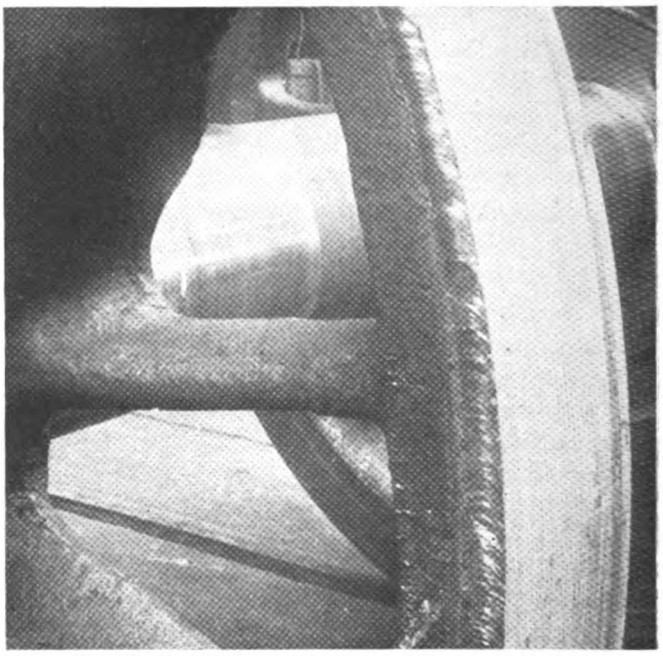
THE increasing number of driving-tire failures which were occurring on fast passenger and freight locomotives caused concern to the officers of the Canadian National mechanical department. During the investigation of these failures it was discovered that tires on newly built power, or on engines which had wheel centers turned before new tires were applied, had not failed. This indicated that the cause of the tire breaking had some relation to the condition of the wheel center. Although the standard shop practices were followed in turning the rims when out-of-round, a number of rims were apparently pitted or distorted and the new tires applied did not have a perfect metal-to-metal contact.



Two-pass welding gives this finish when applying one-piece liners to driving-wheel centers

The decision was made that all wheel centers would be turned when tires were being applied so that at each application of a tire there would be new metal contact between the two surfaces. It then became necessary to place a limit on the permissible reduction in the diameter of the wheel center. This limit was set at ¼ in. less than standard diameter. When wheel centers had been reduced to this limit consideration was given to some method of restoring them to the original diameter. The A.A.R. recommendation was adopted.

This recommended method consists of the application of a steel plate liner in three sections which were welded to the wheel center. While this method was partially successful trouble was experienced in applying the sectional liner. It was found almost impossible to obtain a metal-to-metal contact between the surfaces which is essential before any welding is attempted. Further experimentation developed the idea of applying the liner in one piece and this plan was finally adopted.



Detail of the weld on the outer side of a driving wheel center which is restored to size by the application of a one-piece liner

* A prize-winning paper submitted in the recent $200,000 Industrial Progress Award Program of the James F. Lincoln Arc Welding Foundation.

† Assistant mechanical engineer, shop methods, Central Region, Canadian National, Toronto, Ont., Canada.

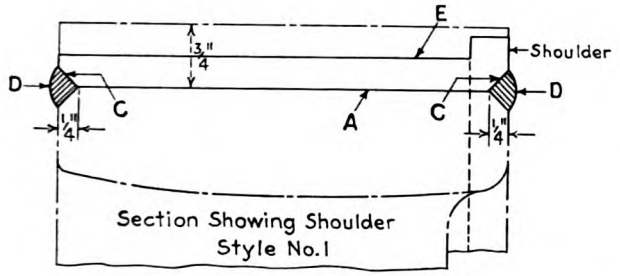
A mild-steel liner is cut to length and the edges are bevelled on a plate planer. The liner is rolled to the required diameter after which the joint is welded. This ring is then placed in a large boring mill and bored to an inside diameter which will provide a shrink fit on the wheel center. The wheel center is turned to a diameter of ¾ in. less than the standard diameter, and the edges are bevelled. The ring is then heated, using a gas-fired heating ring placed on the wheel center, and allowed to cool. When cool, the edges of the liner are arc welded to the wheel center.

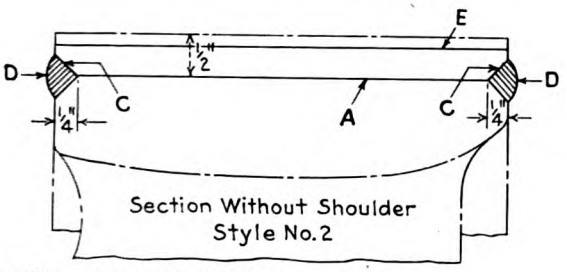
The ring is tack welded at intervals on both sides of the wheel, using a 5/32-in. shielded-arc electrode. The pair of wheels, mounted on the axle, are placed on end as this position facilitates down-hand welding. Two operators, each using a Lincoln 400-amp. dual-control welding machine do the work. One operator welds on the lower wheel and the other on the upper wheel. The first pass is made with 5/32-in. shielded-arc electrodes, the second pass with ¼-in. shielded-arc electrodes. These electrodes are of the same type as Lincoln Fleet Weld No. 7. Upon the completion of one side of each wheel, the position of the wheels is reversed and the operation repeated.

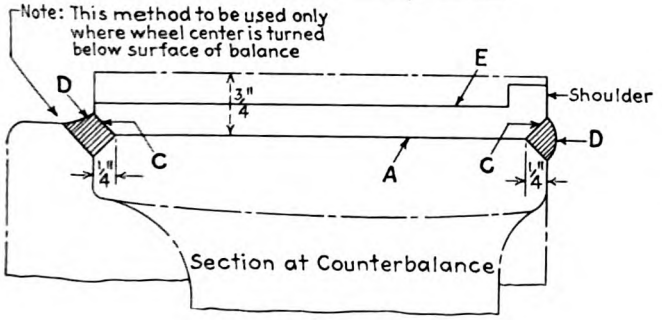
This method is less costly than the application of the three-piece liner, chiefly because extensive clamping op-

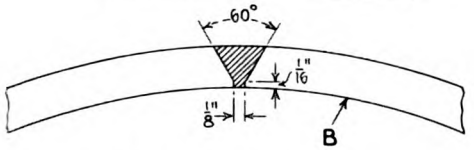
Cost of Machining Old Wheel Centers Mounted on Axle for Application of Steel Bands to Restore Original Diameter

Labor (including cost-of-living bonus)		
Machining wheel centers ready for band, 5 hr. at 75 cents	$3.75	
Turning bands after application, 5 hr. at 86 cents	4.30	
Shop expense	4.03	$12.08
Manufacturing bands—material		
Mild steel, 480 lb. at 3¾ cents per lb.	18.00	
S. A. E. electrodes for welding, 65 lb. at 10 cents per lb.	6.50	
Stores expense	1.47	25.97
Labor (including cost-of-living bonus)		
Machining bands before welding and rolling, 10 hr. at 86 cents	8.60	
Welding joints in bands, 1 hr. at 86 cents	.86	
Bore to fit wheel center, 12 hr. at 86 cents	10.32	
Weld to wheel center, 18 hr. at 86 cents	15.48	
Shop expense	17.63	52.89
Total		$90.94







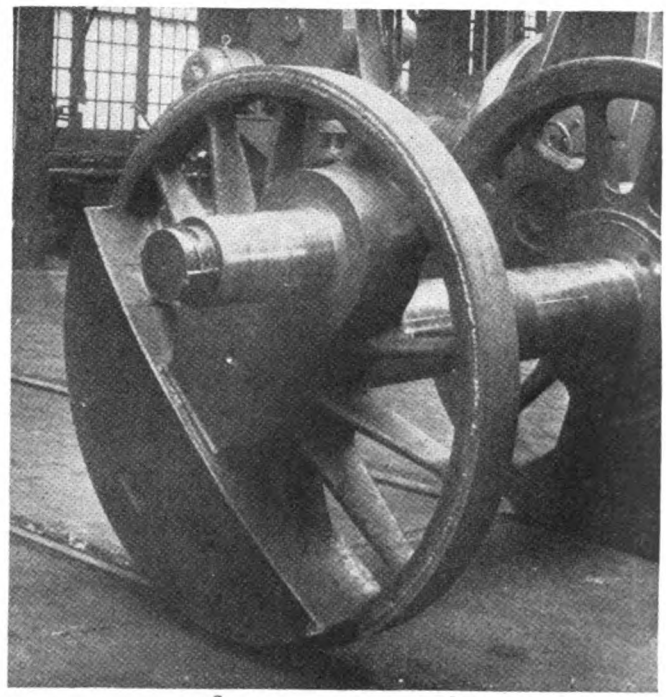


Detail of Joint in Ring

Note:

1. Turn wheel center ¾" below original standard diameter at A
2. Liner to be cut to length, rolled, welded, bored to diameter B as required and shrunk on, then machined to finish with or without lip as required. Edges of ring beveled at C before rolling. Thickness of liner as shown on styles 1 or 2
3. Weld both edges of ring at D
4. Turn wheel center to original standard diameter and contour E
5. All welding must be done by electric arc process using approved type shielded arc electrodes

Various conditions which may be met in different types of wheel centers



Driving wheel centers which have been restored to size by the application of one-piece welded liners—Proper machining and shrink-fitting of the liner assure good metal-to-metal contact before welding

Cost of Making Up and Applying Two New Wheel Centers and Two New Crank Pins to the Old Axle

Material		
Two wheel centers, 4,600 lb. each	$1,080.00	
Two crank pins, 465 lb. each	120.00	
Stores expense	72.00	$1,272.00
Labor (including cost-of-living bonus)		
Remove axle and crank pins, 3 hr. at 75 cents	$2.25	
Machine two new wheels, 40 hr. at 86 cents	34.40	
Apply wheels to axle, 3 hr. at 75 cents	2.25	
Machine and apply hub liners and keys, 7 hr. at 86 cents	6.02	
Turn crank pins and bore crank-pin holes, 7 hr. at 86 cents	6.02	
Apply crank pins, 2 hr. at 86 cents	1.72	
Turn wheel centers for tire, 3 hr. at 86 cents	2.58	
Shop expense	27.62	82.86
Total		1,354.86
Credit for scrap		75.99
TOTAL		$1,278.87

Comparative Statement Showing Estimated Savings

Cost of applying two new wheel centers with new crank pins to the old axle	$1,278.87
Cost to restore wheel centers to the original diameter by the application of steel bands, arc welded to the wheel center	90.94
Saving per pair of wheels	$1,187.93
Saving per wheel	593.96
Proportionate cost saving, per cent	92.2
Estimated number of wheel centers which will be reclaimed per annum over the entire system represent a total saving of	$29,698.00

erations are unnecessary and the application is easier. It is believed that longer life is obtained from wheel centers which are reclaimed in this manner. The steel liner is tougher than the original casting and provides a better seat for the tire. Necessary figures to substantiate this statement, however, would be difficult to obtain as it is almost impossible to keep an accurate record of the service of any particular wheel. It is realized that, with present-day high speeds and maximum loadings, the closest attention should be given to the condition of wheels and tires.

The tables give the cost of various operations. From them it will be observed that the method described shows a considerable saving in labor and material.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Welding on Worn Brake Shafts

Q.—Can worn freight-car brake shafts be welded successfully?

A.—Worn freight-car brake shafts can be built up by welding. The areas worn by contact with the ratchet wheel and brake wheel can be rebuilt to near the correct size using the torch and a mild-steel rod. After welding they can be hammered to the exact dimensions. Anneal brake shafts after welding. Cracked or broken brake shafts should not be welded.

Flashing a Generator

Q.—Would you explain what is meant by flashing a generator?

A.—Occasionally, after a generator has been idle for some time or has been overhauled, it will refuse to build up its voltage when started. One method of curing this condition is to "flash the generator." Flashing is a method of establishing the residual magnetism of the field structure with the correct polarity to cause the machine to generate. It is done by passing a relatively heavy current through the field windings momentarily using another machine or other external source of direct current.

Welding Broken Guide-Yoke Castings

Q.—Can a guide-yoke casting which has been broken in two where it fastens to the guide-yoke brace be welded successfully without having too much distortion?

A.—There is no reason why the guide-yoke casting cannot be welded satisfactorily without any distortion. Vee out the break on both pieces from each side leaving a $\frac{1}{16}$-in. line in the center of each that is uncut. Drill a heavy plate, 1 in. or more in thickness to match the link-trunnion fit on the guide yoke. Fit the pieces together and bolt the heavy plate in place. This will hold the broken piece square with the balance of the yoke. Insert three short pieces of $\frac{3}{32}$-in. bare rod between the edges of the vee to care for contraction in the weld. Two operators, welding from both sides at the same time should make a $1\frac{1}{2}$-in. tack weld at the bottom of the vee. The next tack weld is made at the top of the vee and the third and last tack is made in the center. Welding is then carried from the center tack to the top one. Still welding from both sides, the operators drop down to the bottom tack and complete the weld. When it is possible, a 10 per cent reinforcement is added to the weld. A guide yoke welded in this manner shows no distortion and when cool may be applied without machine work.

Repairing Throttle Seats

Q.—Is it possible to fill in a worn or steam-cut spot in a locomotive throttle seat without preheating?

A.—Worn or cut places in the throttle valve seat in the "bootleg," or stand pipe, can be filled with wear-resisting bronze by local preheating. Using a large welding head in the blowpipe, the flame is played around the bowl of the "bootleg" until the casing is brought to the "sizzling" point. A small welding head is then substituted for the large one, and, using a small diameter rod, the bronze is applied as quickly as possible. The resulting weld is then chipped and filed to facilitate subsequent grinding.

Welding Repairs On Reverse Shaft Bearing

Q.—What method do you recommend for building up reverse-shaft bearings?

A.—Many conditions enter into the rebuilding of reverse shaft bearings. When cast-iron or steel boxes are used on the reverse shaft, it is advisable to use bronze on the bearings. Care must be exercised when rebuilding with bronze to be sure that the shaft is clean. The operator should deposit enough bronze so that the bearing will machine free from holes and also that the box may be bored if necessary.

When the boxes on the shaft are bronze or have bronze caps, as sometimes happens, a more successful repair will be made if the shaft is rebuilt with steel. Usually a heavy deposit is needed and a large electrode should be used, preferably $\frac{1}{4}$ in. either bare or coated. A deposit of coated rod will machine more easily and give a better surface.

Welded Handles in Locomotive Coal Picks

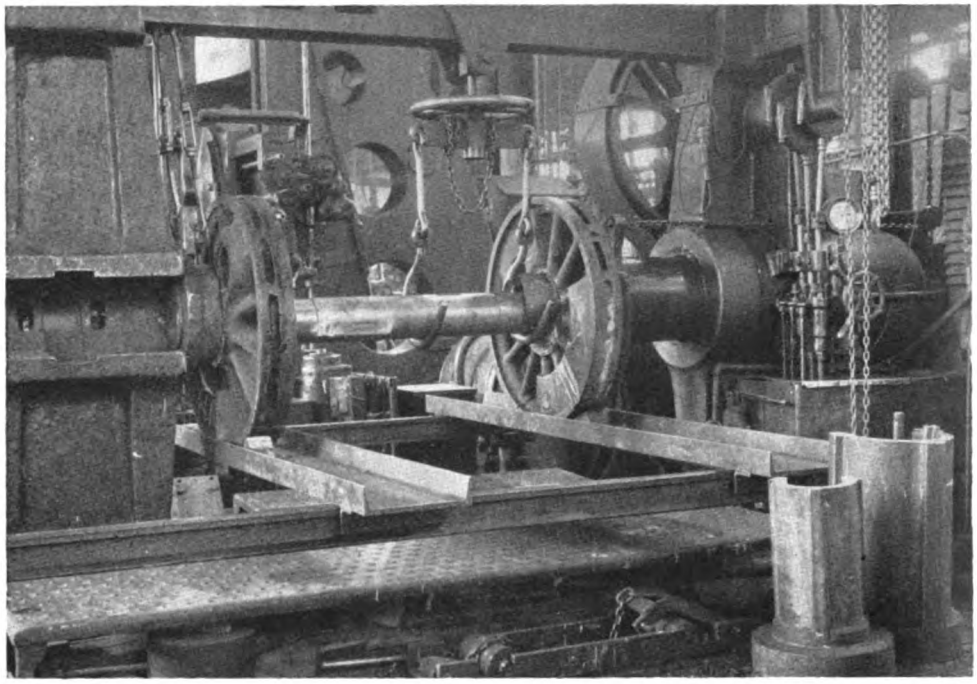
Q.—We have been experimenting lately with pipe handles in our locomotive coal picks. The blacksmith has been putting these on and heading them over but the pick soon works loose. Can these be welded so that they will stay?

A.—Coal picks can be welded to pipe handles and they will never work loose. A pick with a round hole will usually take a piece of $\frac{3}{4}$-in. standard-weight pipe. Drive the pipe into the pick until the end is flush. Using arc welding and a $\frac{5}{32}$-in. electrode weld a bead around the top end. Then stand the pick with the handle up and weld another bead around the other side. A piece of welding rod six or eight inches long fastened to the welding bench will hold the picks upright and enable the operator to turn them at will.

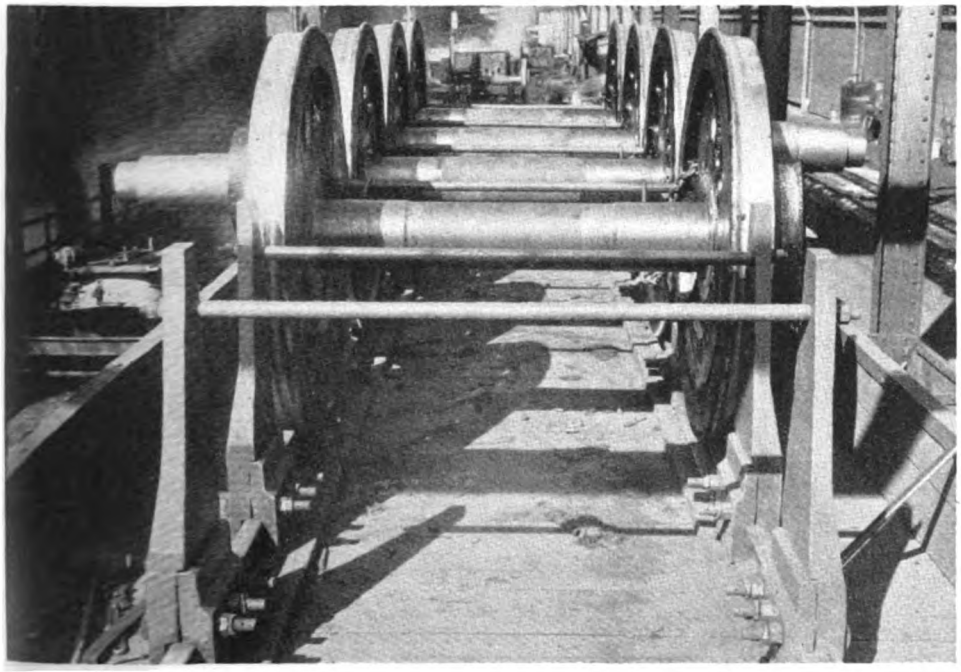
Driver-Wheel Handling Car

All heavy repair operations on locomotive driving wheels for the Louisville & Nashville are concentrated at the main repair shops, South Louisville, Ky., where machine equipment and other facilities are available for doing the work accurately, quickly and at relatively low unit cost. This method of operation, however, involves shipping worn or otherwise defective driving wheels from outlying points to South Louisville and then returning them after they have been repaired. For this movement of mounted driving wheels, the L. & N. has found the type of special gondola car, shown in two of the illustrations, to be most satisfactory.

Two rails of the proper length, with standard gage spacing, are securely mounted on the gondola car floor and carry relatively heavy and well-braced vertical steel spacing bars, which are adjustable on the rails and serve to separate the driving wheels and hold them firmly in position in the car. Experience with early shipments of driving wheels loaded in this manner shows the absolute necessity of firm anchorage of the bottom supporting rails to the car structure. In addition to being securely fastened to the car floor by bolted connections, small auxiliary anchor plates are welded at one end to the rail and at the other to the car underframe, thus preventing longitudinal movement of the rails on the car floor.

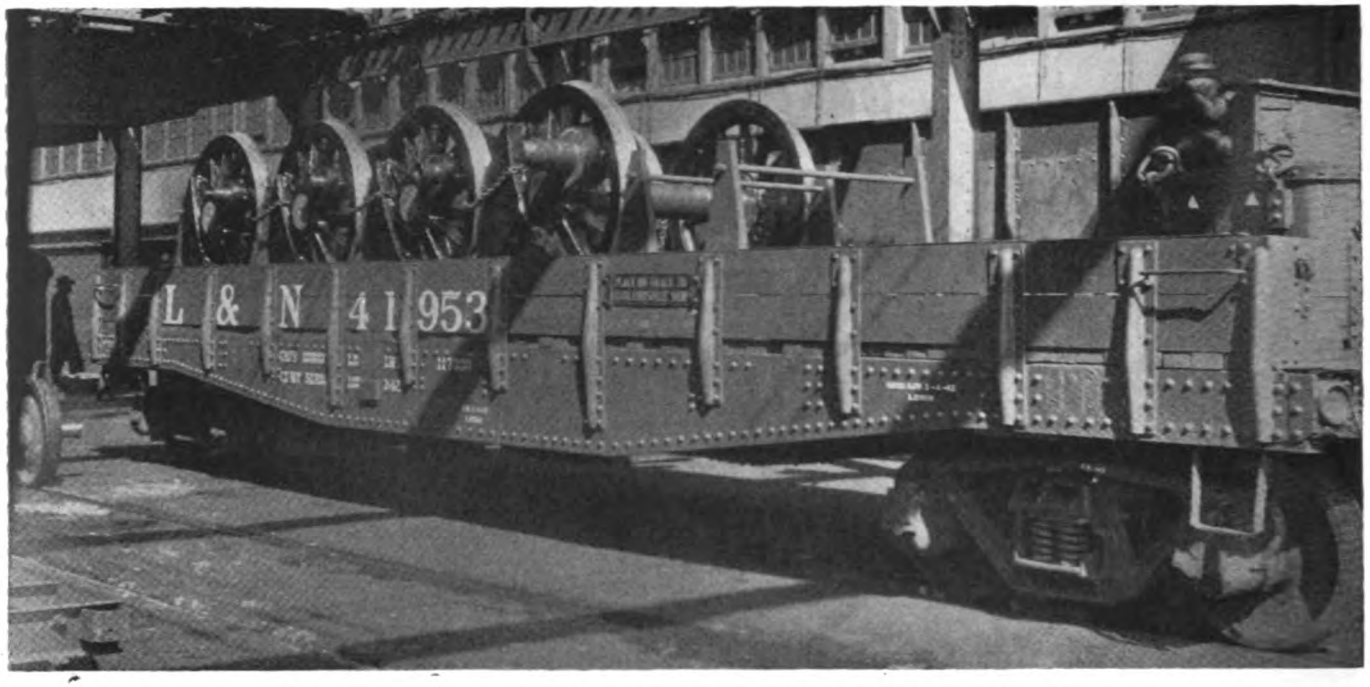


The driving wheel press at South Louisville shops is equipped with an elevating platform to accommodate wheels of various diameters



The wheels are secured between adjustable separator bars

As an additional precaution in the interest of safety, the driving wheels are also chained together. The balance of the car not occupied by driving wheels is available for the shipment of driving boxes, spring rigging or brake rigging, etc., all of which goes on the same locomotive. A rectangular steel container, equipped with



Gondola car equipped for the shipment of locomotive driving wheels on the L. & N.

rings for the attachment of crane hooks, is used in one end of the car for the easy handling of some of the smaller parts.

The large wheel press at South Louisville is equipped with a special elevating steel platform to accommodate wheels of different diameters without the use of cumbersome and relatively unsafe wood blocking. This platform consists of a steel frame mounted on four air cylinders set in the shop floor and interconnected so that one operating valve raises or lowers all pistons simultaneously. The steel platform carries a rail on either side which serves as a support for the cross channels which hold the wheel centers at the proper elevation while either wheel is being mounted on the axle. The device works equally well in all dismounting operations.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Operation of Fusible Plugs

Q.—When a fusible plug drops in the firebox does the plug itself drop or is it the fusible metal in the plug that lets go?—F. L. R.

A.—There are various types of fusible plugs used in locomotive fireboxes. A typical standard fusible plug is illustrated in Fig. 1. The fusible plug is made of bronze and it is screwed into the firebox crown sheet. It has a solid core of fusible metal which has a melting point of 400 to 500 deg. F. In case of a low-water condition the temperature of the crown sheet rises until the melting point of the alloy metal core is reached, the core melts and drops out and allows steam and water to enter the firebox. The plug itself remains in the crown sheet. Fig. 2 illustrates one of the many variations of fusible plugs in use. This plug is screwed into the firebox crown sheet in the same way as the plug shown in Fig. 1. However, this plug has an additional plug, or button, inserted in it

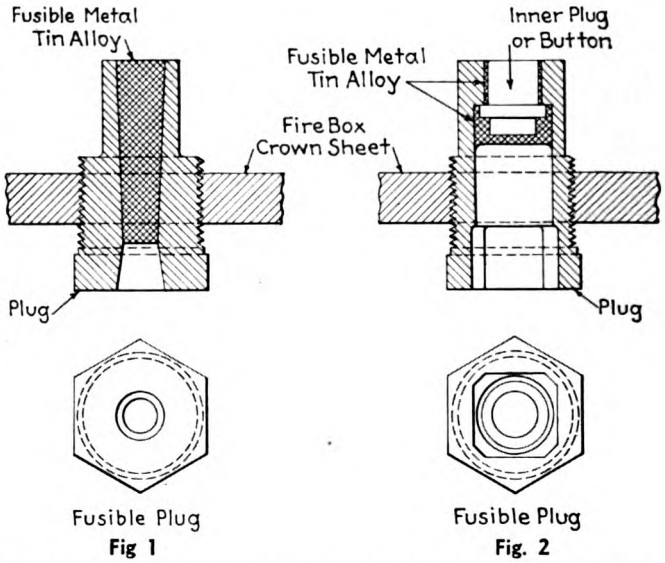


Fig. 1—(Left): A common design of fusible plug. Fig. 2—(Right): One of many variations

which is held in place with a fusible metal having a melting point of 400 to 500 deg. F. A low-water condition raises the temperature of the crown sheet until the melting point of the alloy metal holding the inner plug, or bottom, is reached, the alloy metal melts out and pressure on the inner plug causes it to drop. The plug itself remains in the crown sheet. This type of plug should function more rapidly because pressure is acting on the inner plug and, as the fusible metal reaches a certain degree of softness, the pressure on the inner plug forces it out of

the plug body. In no case is the fusible plug inserted in such a way that the plug itself drops.

Magnaflux Testing Of Locomotive Boilers

Q.—Will you kindly explain how cracks are found by Magnaflux method? Is this method applicable to locomotive boilers?—M. D. R.

A.—The Magnaflux method is a magnetic-dust method of discovering invisible cracks and defects. This dust is manufactured by the Magnaflux Corporation and is generally known as Magnaflux powder. It is a basically metallic iron that has been finely ground to pass a 100 mesh sieve.

The object to be tested must first be magnetized, the test is then performed by sprinkling the powder lightly over the area to be examined and then striking with a hammer to cause the powder to arrange itself and line up over any defects that are present. Where a crack exists in a magnetized area, the powder will attempt to bridge the gap between the two edges forming a distinct line over the crack.

The method could be applied to a locomotive boiler; however, it would hardly be practical due to the size of the boilers and the limited means of handling.

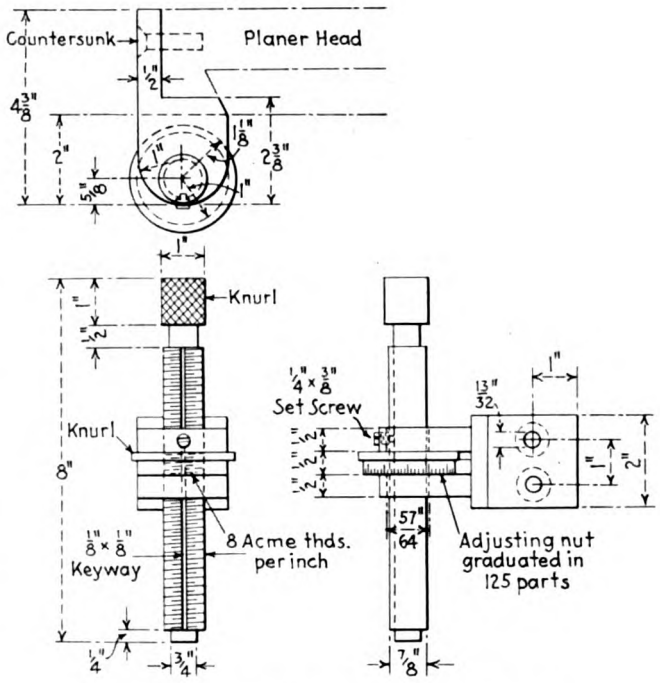
To inspect any surface, it must be positioned so that it doesn't slope too much or the powder will slide off and will not give good indications. When testing the circumferential seams or shell of a boiler, it would have to be turned as the testing progressed and only that portion of the seam or shell from which the powder did not slide off could be tested. This procedure would require that the boiler be revolved which would hardly be practical for a locomotive boiler.

To magnetize the boiler would also be a problem, requiring the winding of several turns of a flexible energized cable through or around the boiler. Longitudinal winding is preferred as it is a more efficient way of magnetizing.

For examining a local condition, or small area, this method could no doubt be used on a locomotive boiler. The boiler would have to be placed so that the area to be examined was level.

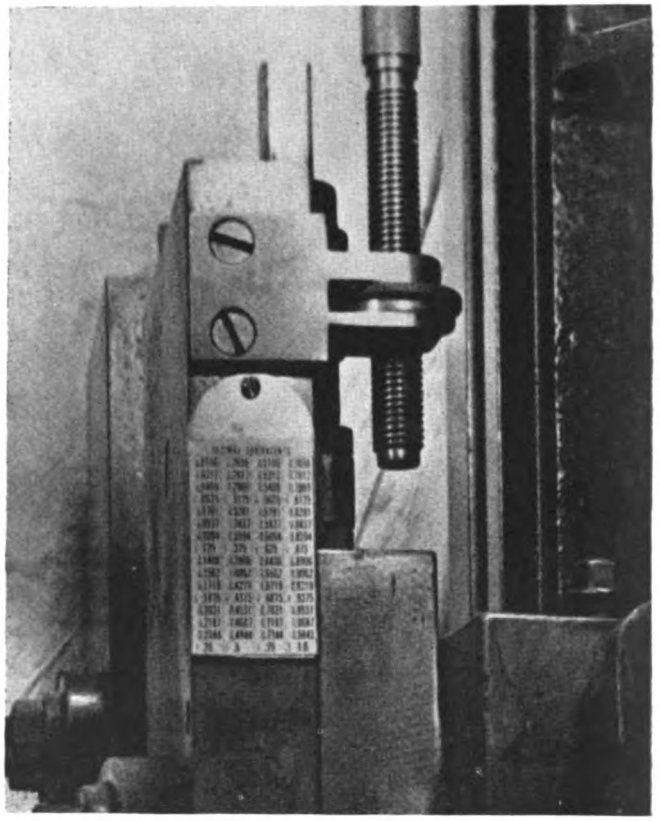
The area to be examined can be magnetized by either of two methods; by magnetizing the area with a pair of portable electro-magnets, with the magnets about a foot apart, or by passing a heavy current through the area to be tested. This can be accomplished with an apparatus having two metal fingers set in an insulated handle and having no contact with each other. The contact points are pressed on the surface, the area between them is magnetized by the flow of current and the test is made while the current is on.

The area to be tested should be wire brushed and any scale or sediment removed. A perfectly clean bright surface is not necessary as the powder will reveal cracks through a light scale or rust coating, but it is desirable all loose scale or rust should be removed before applying the powder.



Details of planer stop having micrometer adjustments

To start a cut, measure it and find that you have 1/64 in. more or .015 plus to come off, and to be able to drop the head down exactly .015 in. run your cut across without measuring any more, and if the next part to plane



Micrometer planer stop mounted on planer head

is a given amount thicker or thinner you can raise or lower the tool the exact number of thousandths you want.

It is also very convenient in planing off-set surfaces. Do not confuse this with the micrometer dial on the feed screw. This is a positive stop with micrometer control.

Micrometer Stop Block for Planer Head

In doing duplicate work on a planer or work near to a given thickness, the micrometer controlled, positive stop shown on this page is a definite labor saver.

With the Car Foremen and Inspectors

Adjustment of Piston Travel By the Use of the Hand Brake

*By P. J. Hogan**

There are many points on all railroads where cars cannot be reached with air to make tests for the adjustment of piston travel. The adjustment can be accomplished by the use of the hand-brake method as follows:

1—See that the hand brake is released.

2—Move the brake rigging slack to the piston lever by pushing the piston lever towards the brake cylinder.

3—Push the cylinder push rod back into the piston sleeve until it contacts the piston.

4—Mark the push rod outside the sleeve.

5—Set up a good tight hand brake.

6—Measure the distance from the mark on the push rod back to the sleeve, this will be the length of the piston travel.

If the car is equipped with the old Master Car Builders' brake shaft and wheel, add ½ in. to the distance found. If the car is equipped with a good geared hand brake, the distance found will be equal to the piston travel produced by the air brake method.

With the limited time usually available for preparing trains in departure yards, everything possible should be done to keep the piston travel properly adjusted on all cars in order to avoid delays.

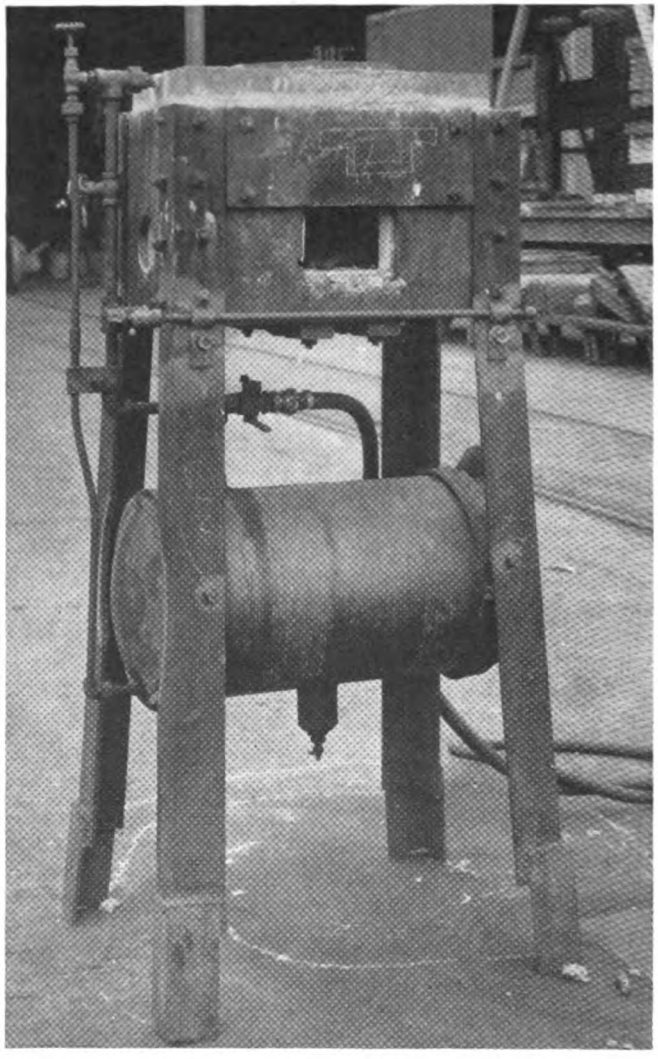
The hand-brake method of adjusting piston travel is not new. I have used it for over 40 years. However, I fail to find many people making use of this convenient and helpful method.

Rivet Heater With Improved Burner

The portable rivet-heating furnace, shown in the illustration, is equipped with a new and non-patented type of oil burner, developed at the South Louisville, Ky., shops of the Louisville & Nashville, which has shown unusually favorable results in service, both from the point of view of noise reduction and fuel economy. This burner may be applied equally well to larger stationary rivet heaters if desired.

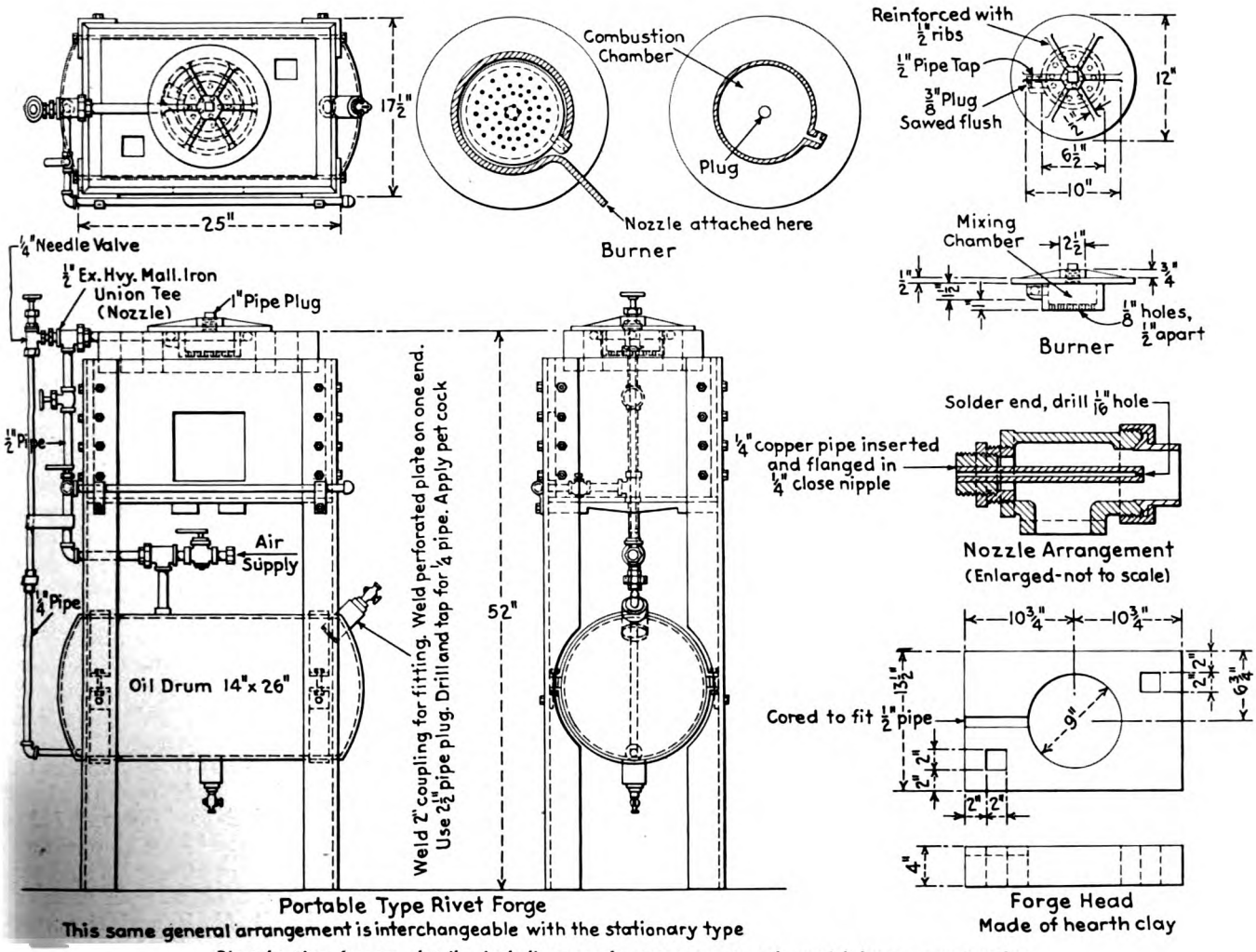
The particular rivet heater illustrated is of the conventional type, 52 in. high, with an exterior furnace area of 17½ in. by 25 in. and is made of steel plates and 3-in. angle legs. The furnace itself is lined with firebrick in accordance with the usual practice and has a removable head made of hearth clay. The main fuel supply is carried in a 14-in. by 26-in. oil drum suspended between the furnace legs and arranged to be supplied with air pressure on top of the fuel oil from the same pipe line which carries air to the burner nozzle. A ¼-in. pipe line, connected to the bottom of the oil drum, conveys fuel to the burner by means of the pipe connections and ¼-in. needle valve illustrated. The usual air shield to protect the operator against heat from the furnace is supplied by means of the small perforated pipe on the front of the furnace.

The construction of the fuel burning nozzle and the improved burner are shown. The nozzle consists of a ¼-in. copper pipe with a restricted 1/16-in. opening in one end, this pipe being supported in a ¼-in. close nipple and extending into the ½-in. malleable-iron union tee, provided for the first mixture of air and fuel particles. This mixture then passes through a short pipe section to the burner proper, which is inserted in a cavity in the clay head or top of the furnace. The burner consists of a gray iron casting with a combustion chamber in the center and small perforated holes extending from



Portable rivet-heating furnace developed at the South Louisville shops of the L. & N.

* Supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.



Rivet-heating furnace details, including nozzle arrangement and special burner construction

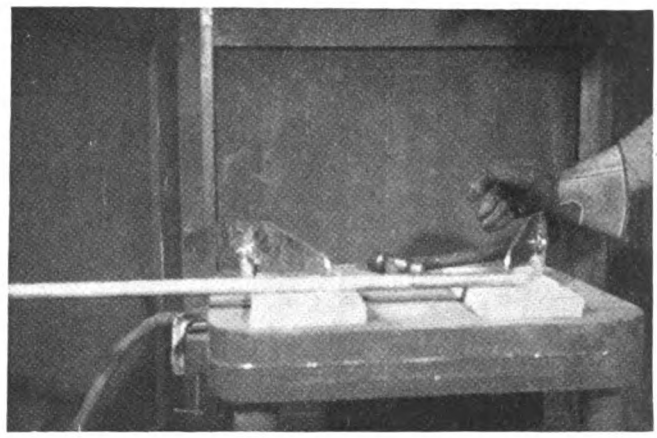
this chamber down to the furnace proper. The fuel delivery pipe makes one turn around the outside of the combustion chamber for preheating purposes and preliminary firing of the fuel takes place in the combustion chamber. The heated mixture of burning fuel oil vapor and air is forced downward into the main part of the furnace where combustion is completed quietly but at a high temperature.

The designs of this combustion chamber is such that the fuel oil and air mixture is baffled to a considerable extent and a very large proportion of objectionable noise, usually associated with the operation of rivet heating furnaces, is eliminated. In addition, it is said that this type of burner effects a fuel saving of at least fifty per cent as compared with other types formerly used at South Louisville shops.

Home-Made Clamping Table Speeds Welding Operations*

By Vernon Wainscott†

The process of welding comparatively small articles or irregularly shaped pieces of metal often proves quite exasperating as well as time consuming. Any welder can vouch for the fact that it is a common occurrence to spend 10 or 15 min. placing objects in just the right position for welding only to have them fall after gloves have been slipped on and the welding helmet pulled down over the face. If, luckily, this does not happen and the welder gets to the point of applying the electrode, it may stick to one of the parts, and then the whole process must be repeated. Much valuable time and patience is expended.

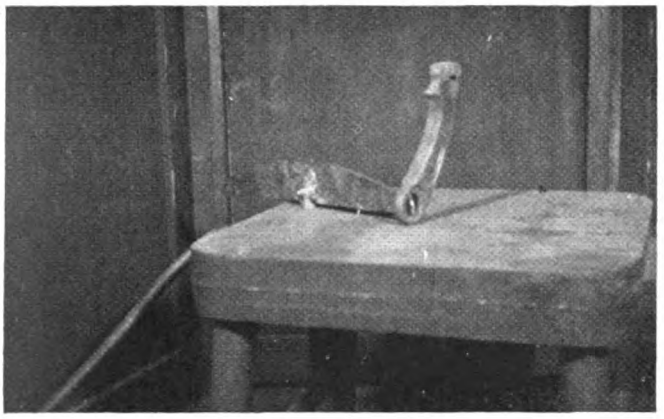


A light blow of the hand sets the clamp firmly and holds the work piece in the desired position

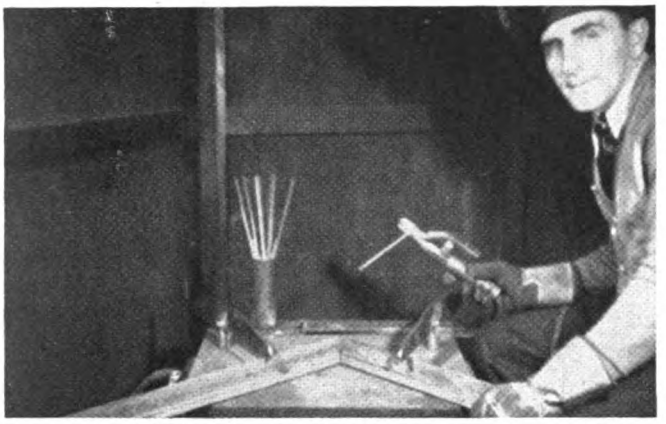
To overcome the above difficulty, the writer devised a means of securely clamping the parts to be welded. This

* Abstract of a prize-winning paper submitted in the recent $200,000 Industrial Progress Award Program of the James F. Lincoln Arc Welding Foundation.

† Coach Repairman, Southern, Ludlow, Ky.



A lock lifter positioned for reclamation by welding



Angle-section frames can be clamped in position while the corners are being welded

method may be employed by anyone at negligible cost and in a few minutes.

The top of the welding table measures approximately 22 in. by 24 in. and, it is 2 in. in thickness. This piece of metal, retrieved from a scrap pile, contains two holes in each end, bored about 2 in. from the edge. The original use of the table top and the purpose of the four holes is unknown, but after numerous experiences with tedious welding jobs, a staybolt, to which a crosspiece had been welded at the top, was inserted in one of the holes as a brace against the part to be welded.

The thickness of the metal table top causes the bolt to bind and once the clamp is wedged in place there is no possibility of its slipping during the welding process. A slight tap with the heel of the hand, sets the clamp until the job is finished. To remove the bolt a blow with the fist is generally sufficient, although a rap with a hammer on the end beneath the table may sometimes be required.

Although the writer has found two or three clamps adequate for his purposes, there is no end to the possibilities for the use of these clamps. Any number of holes may be bored in the table top at various intervals, making it possible to brace, on one or both sides, any or all of the parts to be welded. The ends of each crosspiece or jaw pieces may be different lengths, thus providing a variety of clamps with a minimum number of holes. The ends may be of varied sizes, shapes, and thicknesses. For example, the clamp shown holding a lock lifter in position for welding might be more effective with a pointed end. Had the hole been slightly smaller, the blunt end could not have been inserted. With a metal-cutting band saw the clamp can easily be shaped to suit the needs of the Job.

The clamp leaves all objects in position to be welded from either side without interference. Pieces can be set at 80 deg., 70 deg., or almost any angle and held firmly. Unwieldy frames can be held in place for easy welding. The great advantage of this clamping table is the facility with which a welder may provide a clamp of his own design to suit his own particular need.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

140—*Q.—How do the F. S. 1864 and F. 1864 relay valves connect up in the charging position?* A.—At the F. S. 1864 relay valves on the cars having speed governors and the F. 1864 relay valves on the remaining cars, the supply reservoir air from connection *6* charges the chamber around application piston *30* and its pilot valve *32;* pipe *16* is open to the control valve, passages *16* and *16a,* past double check valve *228* to passages *8a* and *8* to the straight-air pipe which is open at the No. 21 B-magnet valve exhaust. This connects diaphragm chambers *P, N, K* and *A* of the relay valve through passages *19, 18, 17,* and *16a* to the magnet portion. With the M.S., L.S. and H.S. magnets deenergized, passage *19* is connected past the upper magnet valve *161b* and chokes *138* to passage *15,* and passages *18* and *17* past the lower magnet valves *161* and *161a* and chokes *140* and *142* to passage *15.* Passage *15* is connected past the unseated supply valve *92* and passage *16c* to passage *16.* As passage *16* is connected to the No. *21-B* magnet valve exhaust, the diaphragm cavities *P, N. K* and *A* are exhausted and piston spring *42* holds the diaphragm assembly released. All pressure is thus released from lever *43* which floats freely, permitting the exhaust piston *25* and its valve *23* to remain open, releasing the air from chamber *F* and connected brake cylinders to exhaust *Ex.*

141—*Q.—What takes place when a straight-air brake application is made on the power unit?* A.—When a brake application is made on the power unit, a master controller closes the application and release wires, thus energizing the coils of the application and release magnets on the No. *21-B* magnet brackets on each car (see wiring diagram Fig. 16). The armatures of the magnets are pulled down against the spring pressure beneath the valves; release magnet valve *62* is seated, closing off the straight air pipe exhaust passage *x* in each magnet bracket, and application magnet valve *34* is unseated, opening passage *6a* to *4b.* Auxiliary reservoir air thus flows to the straight-air pipe, building up the straight-air-pipe pressure throughout the train.

142—*Q—How long does the flow from the auxiliary reservoir continue?* A.—Cut-off valve *5* of the *21-B* magnet bracket is held unseated by spring *17,* permitting the auxiliary-reservoir air to flow to passage *6a* as long as the auxiliary-reservoir pressure exceeds approximately 75 lb., which is the value of spring *10.*

143—*Q.—In the event of loss of auxiliary-reservoir pressure due to straight-air pipe breakage or abnormal magnet-valve operation, is there an effective pneumatic brake application available?* A.—Yes.

144—*Q.—What provides for such an emergency?* A.—Spring *10* will seat valve *5* of the No. *21-B* magnet and thus retain 75 lb. auxiliary reservoir pressure.

145—*Q.—In what position does the brake valve rotary on the power unit remain, for electro-pneumatic service applications of the HSC system?* A.—In charging position.

146—*Q.—This being the case, how do the brake-pipe and auxiliary-reservoir pressures compare?* A.—The brake-pipe pressure is higher on the face of the D-22 BR control valve service piston during applications of the HSC system than the auxiliary-reservoir air back of the piston, as the auxiliary air is reduced into the straight-air pipe at the No. *21-B* magnet valve.

147—*Q.—What position, then, do the service and emergency pistons remain in?* A.—In release position.

148—*Q.—To where does the air flow from the straight-air pipe?* A.—To the D-22-BR control valve, entering connections *8* and passages *8* and *8a,* and moving double check valve *228* to its right-hand seat, thereby sealing off passage *3,* which is open at this time through cavity *Q* of release slide valve *11* to exhaust passage *10.* Movement of the check valve uncovers passage *16a,* through which straight-air-pipe air flows to pipe *16* and thence to the F. S. 1864 relay valve.

149—*Q.—What occurs as the straight-air-pipe pressure is built up to the desired amount?* A.—When so built up (as controlled by the position of the brake valve on the locomotive), the master controller on the locomotive moves to lap position in which the release wire remains energized but the application wire is de-energized. The coil of the release magnet on the No. 21-B bracket is thus de-energized, and spring *35a* closes application magnet valve *34.* The release-magnet coil remains energized, holding release-magnet valve *62* seated, retaining the pressure in the straight-air pipe.

150—*Q.—What action takes place if the straight-air brake application is increased at the brake valve?* A.—Straight-air pipe pressure is increased an equal amount by the operation of the application magnet after which the magnet closes as before.

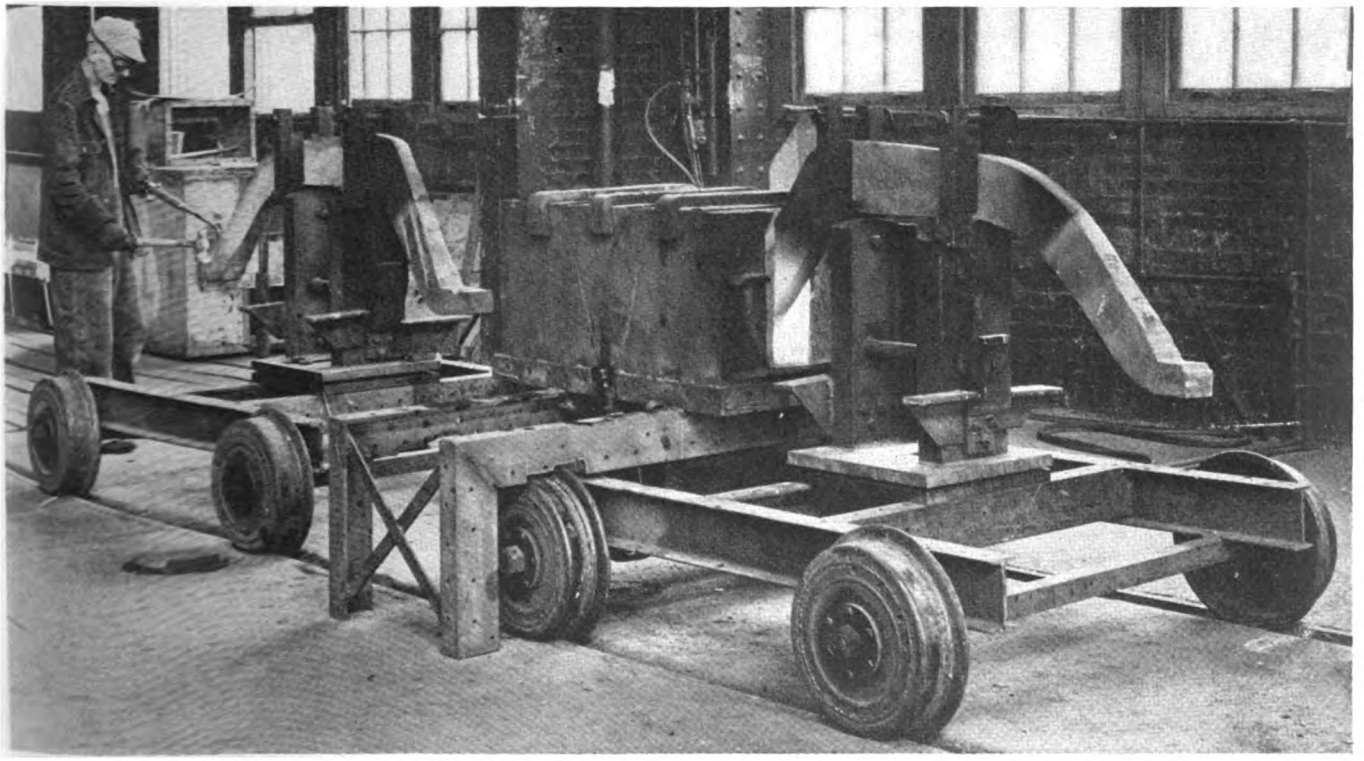
Building Up Worn Equalizer Ends

The method of repairing hook-type equalizers with worn ends, followed at the St. Louis-San Francisco passenger car shops, Springfield, Mo., is particularly interesting because of the ingenious oil-fired preheating furnace arrangement used. This furnace consists of a firebrick-lined steel box, 24 in. sq. and about 4 ft. long mounted on a steel framework which spans a track in the coach shops and is just high enough to clear the frames and wheels of two special pushcars which are designed to support the equalizers while being worked on.

The oil-fired furnace has a narrow opening at each end and reference to the illustration shows how it is possible to heat one end of each of two equalizers at the same time. After being suitably preheated, each equalizer is withdrawn from the furnace by moving the pushcar. An oxy-acetylene torch is used in applying just enough molten steel to build up the worn end of the equalizer to standard dimensions, this material being smoothed slightly by a hand hammer so that the equalizer fits the gage and no subsequent machining is required.

It will be noted that each equalizer is supported between a pair of vertical jaws which are tightened by suitable clamping bolts. These jaws are pivoted so that, when withdrawn from the furnace, the equalizer can be dropped to a horizontal position on either side of the central supporting posts which are themselves mounted on a baseplate designed to rotate about the pushcar center. This gives complete flexibility in handling the equalizers which may be readily revolved end for end, or dropped to a horizontal position on either side as required for the most efficient use of the acetylene torch. It is thus possible for the operator to work in building up one end of the equalizer while the other is in the furnace being heated.

One complete car set of equalizers can be reclaimed in less than half the time formerly required, to say nothing of the saving of about eight hours of machining time.



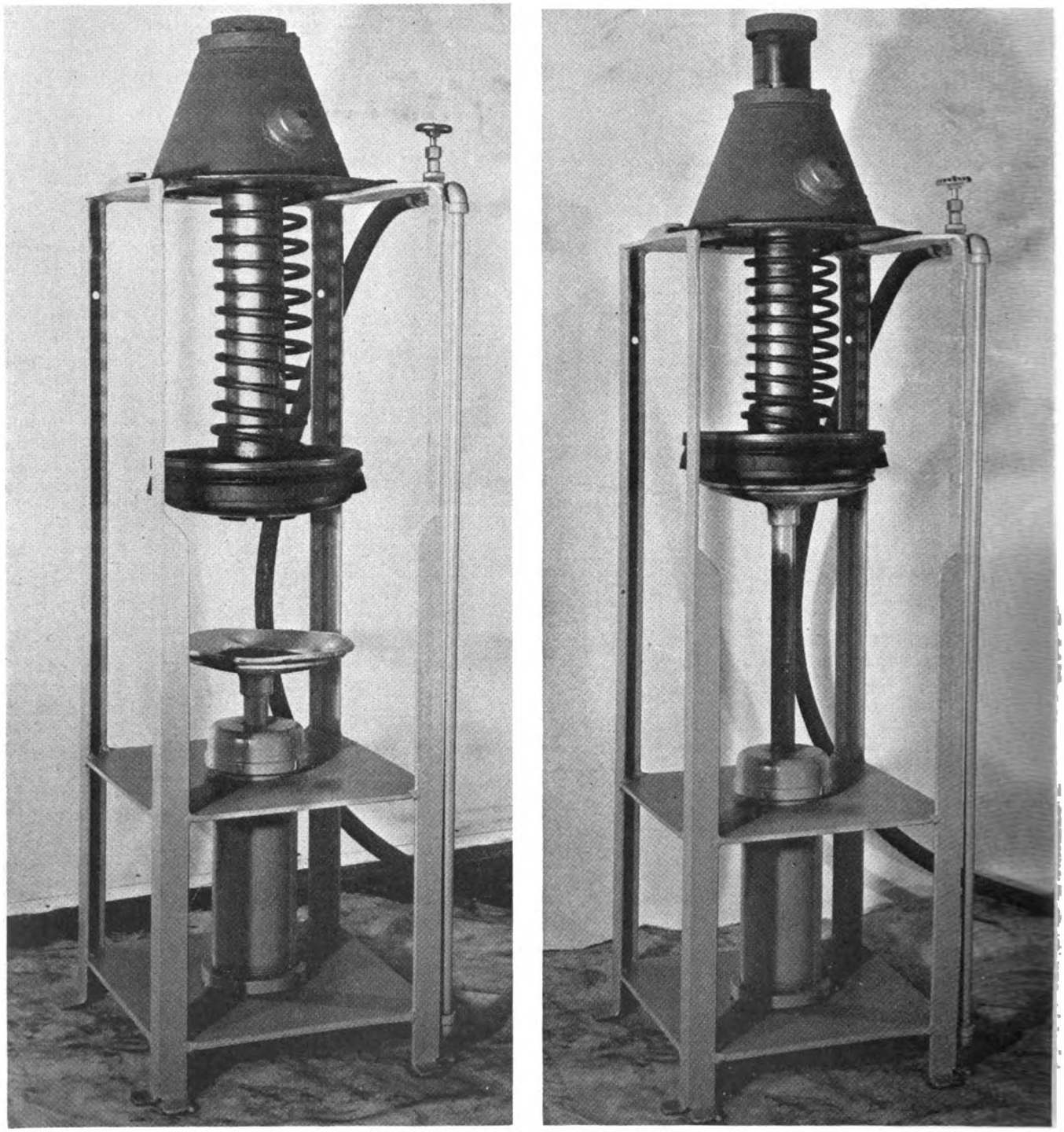
Furnace and special push cars used in building up worn equalizer ends at the Frisco passenger car shops, Springfield, Mo.

Device for Dismantling AB Brake Piston

An unusually neat and effective device for use in dismantling and reassembling pistons of AB freight brake equipment is shown in the illustration. It is a welded construction utilizing 2-in. angles for the 42-in. long corner posts and 16-in. sq. steel base plates, made of ⅜-in. stock welded to the corner angles and serving not only to tie the structure together at the bottom, but to support the operating cylinder which is made of 4-in. pipe with a small piston and piston rod having a 12-in. total travel.

At the upper end of the device a plate with a large U-shape opening is welded to the corner angles to support the AB cylinder head, which readily can be slid over it and held against upward movement by two lugs. The upper end of the operating piston is equipped with a steel disc and leather packing to overcome any tendency to slip when air pressure is applied to move the operating piston upward and bring the disc in contact with the AB piston. Admission of more air to the cylinder compresses the AB piston spring and raises the piston so that the upper holding pin and ring can be removed.

The total travel of the piston in the operating cylinder is 12 in. but only a few inches of the upper part of this travel is used to move the AB piston upward, this amount being ample to enable the repair man to remove the holding pin and ring. When this has been done, the



Device for dismantling AB brake pistons—Left: The cylinder head and piston in place—Right: Piston raised to permit removal of the holding pin and ring

release of air pressure from the operating cylinder drops the AB piston and spring the full 12 in., permitting the piston head to be slipped off the device, after which the piston and spring can also be lifted out. One flange of each of the two front corner angles is cut away at the top to facilitate this operation. In re-assembling the AB brake piston and head, the operations are reversed.

Speeding Up Car-Shop Drilling

The device shown has been developed and installed at the St. Louis-San Francisco car shop, Springfield, Mo., to speed up multiple drilling operations on structural shapes and stacked steel sheets. For this purpose it not only has proved very successful in increasing production but has contributed to accuracy.

Referring to the half-tone illustration, the general construction of the device is apparent. A cross girder has been applied between the two adjacent building columns which are spaced 18 ft. 8 in. apart. This girder is constructed of $\frac{3}{16}$-in. steel plates welded together to form a rigid and strong box section. It is 30 in. deep and the bottom plate is located 3½ ft. above the floor.

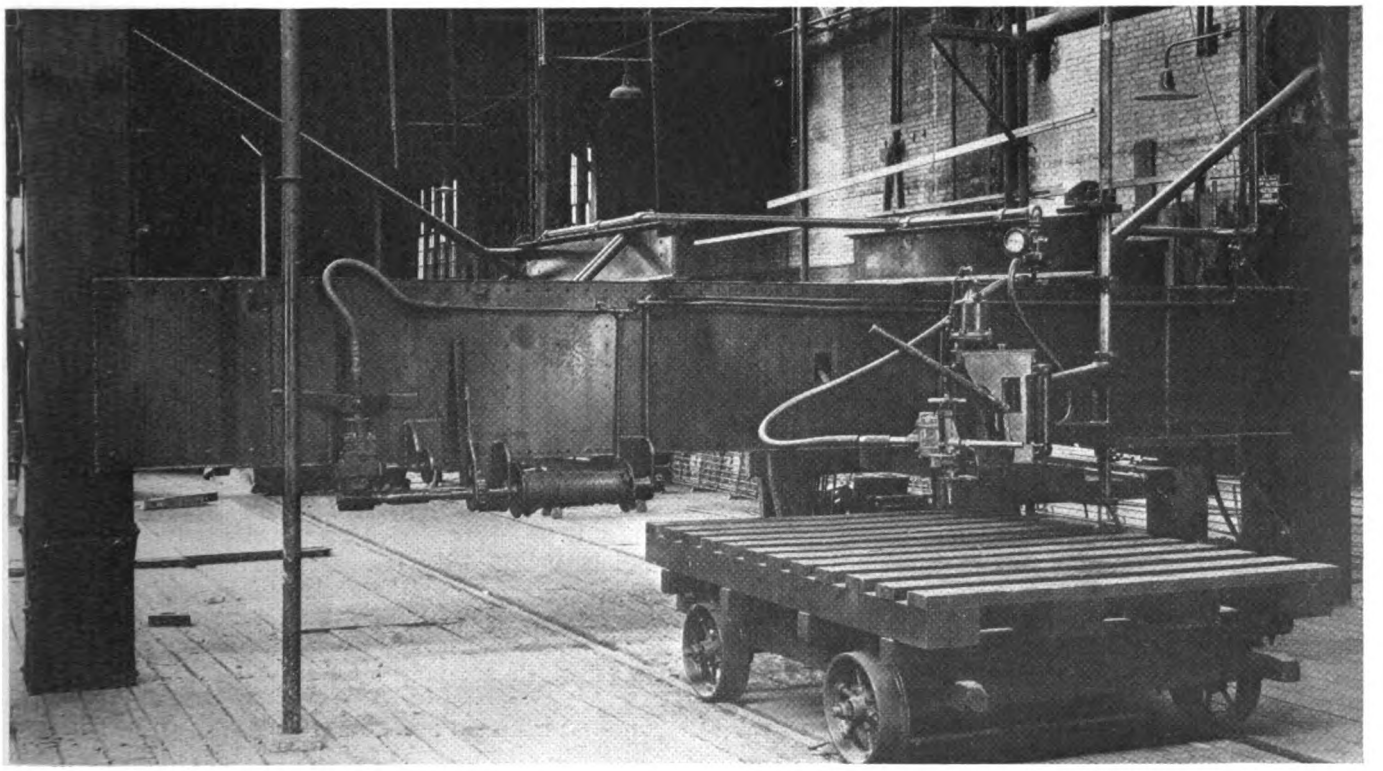
Projecting from this main girder at a point about 7 ft. from the right hand column are two 10-in. I-beams approximately 6 ft. long which are welded in place and stiffened by suitable tubular diagonal braces. These beams are designed to support at their outer ends the vertical post of a Black & Decker high-speed air motor with double-swivel arm support to permit drilling anywhere within a radius of 3 ft. The air motor not only swivels about the vertical bar but is capable of adjustment vertically to suit the requirements of the work being drilled. The motor has a rated speed of 750 r.p.m.

The work to be drilled is supported on a push car, made in this instance with a 4-ft. wheel base and 15-in. flange wheels, but one or more cars of varying lengths may be used as required to support long car sills or other material which is being drilled. In the case of long work, a windlass, either hand or air-motor operated and shown at the left in the illustration, enables the drill operator to move the work to him easily and without leaving his position. A drill similar to the one shown is installed on the other side of the girder about 7 ft. from the left hand building column, thus giving complete coverage for drilling purposes over the entire area of the track, including 3 ft. on each side of the rails.

A particular feature of this drill is the provision for supplementing hand feed by air feed through pressure from a J-type slack-adjuster piston with an air-reducing valve which cuts the pressure from 55 lb. for $\frac{15}{16}$-in. holes to 12 lb. for ¼-in. holes. The use of this air feed keeps a uniform pressure on the drills and speeds up production.

The maximum radius of the drill is 22 in. on the first arm and 15 in. on the second or a total of 37 in. swing altogether. In operation, the hand feed is used to bring the drill down to the center-punch mark after which the air feed is applied. The capacity of the machine includes drilling 6¼ in. of stacked sheets, but it can also be used to drill angles, channels, flat plates and other car materials.

This drill is used primarily on passenger-car work, but a similar design has been successfully developed for use in freight shops where hopper, coal and box cars are built. For accurate work, the rivet holes are drilled $\frac{1}{16}$ in. less than the finish diameter and then reamed out after the car sheets and structural shapes have been assembled, thus assuring accurate full-size holes in which rivets, when properly applied, have maximum holding power. Multiple sheets are drilled all alike and all correct, and no distortion of the material occurs as when sheets are punched.



High-speed drilling device developed and installed at the Frisco passenger car shops, Springfield, Mo.

ELECTRICAL LEADS . . .

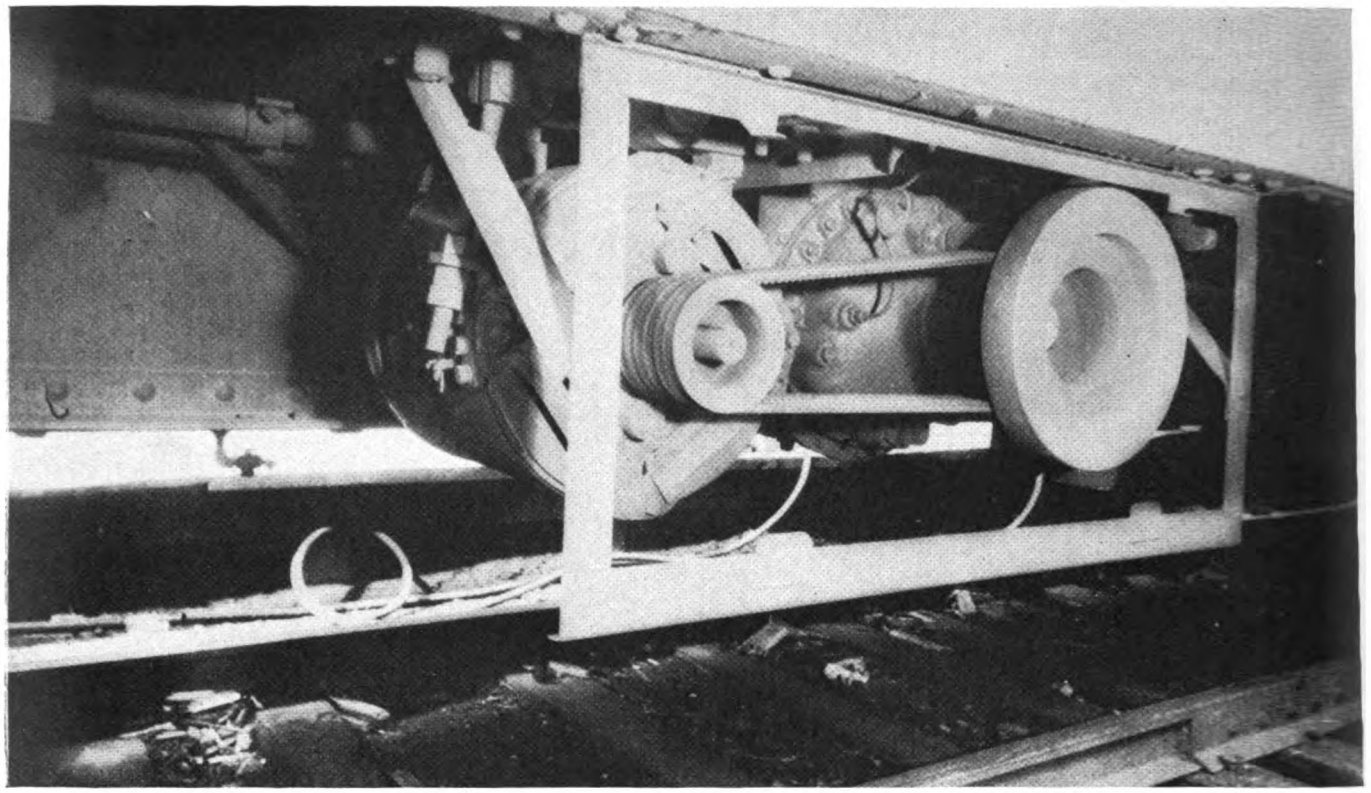


Fig. 1—Arc welded suspension with compressor and motor under a passenger car frame

Arc Welded Compressor Suspension*

THE Lundy Continuous Control air conditioning system was recently applied to eighty cars of one of our largest eastern trunk lines. (The initial installation was described in the October, 1941 issue of Railway Electrical Engineer.) The system is distinguished particularly by its use of a three-cylinder radial compressor which automatically operates on one, two or three cylinders, depending upon the demand for refrigeration. A study of the best method of suspending this compressor resulted in the design described in this article.

The purpose of the arc welded compressor suspension is to support the motor and compressor of the air conditioning unit under a railway passenger car frame, with provision for alinement of the motor pulley, for easy adjustment of belts to the proper tension, and for quick removal of the motor or the compressor for servicing.

Four types of construction were considered. Cast iron was discussed but eliminated as it was not acceptable to the railroad engineers, due to the danger of hidden defects and to the limited space available for the installation. Cast steel was acceptable but was found to be too expensive. Riveted structural sections and arc welded structural sections were considered and cost estimates were made resulting in the selection of the arc welded design.

The suspension consists of an all- arc-welded angle iron upper frame, 28½ in. wide by 53½ in. long, as shown in detail in Fig. 2, which is bolted to the understructure of the railway passenger car. Due to the fact that the railroad engineers were very emphatic in their desire to have all connections of a positive nature, the frame was designed to rest on top of and be bolted to the under-structure of the passenger car with ⅞ in. bolts, as in Fig. 3, which shows the three angles of the car under-structure in dotted lines.

One of the interior angles of the frame, Part No. 24, shown on Fig. 2, is bolted to the suspension frame in order to more readily remove or replace the compressor, the feet of which rest on the upper side of angle irons, Parts Nos. 1 and 24, thus permitting ready removal or replacement of this unit for purposes of servicing.

The 10-hp. motor driving the compressor through a multiple V-belt drive is suspended on a pivoted base which is supported on the horizontal legs of angle irons, Parts Nos. 2 and 20, Fig. 3. This pivoted base consists of four motor arms, Parts Nos. 3, Fig. 5, the outer two of which are bolted to the frame, described im-

* Data and illustrations from a study submitted to the James F. Lincoln Arc Welding Foundation, by John F. Muller, sales engineer and Gonzalo C. Munoz, secretary-treasurer, American Pulley Company, in its recent $200,000 Industrial Progress Award Program for reports and advances and improvements made by the application of arc welding in design, fabrication, construction and maintenance.

mediately above, and have bushed bearings, Parts Nos. 10 and 11, welded to the inside of their semi-circular formed sections, Fig. 4. A piece of 1¼-in. diameter case-hardened cold rolled steel, supported by these two bearings, acts as the pivot for the motor. The two interior motor arms, parts marked No. 3, rest on the pivot rod through similar bearings and form the supports for the four legs of the motor.

The motor arm, Part No. 3, nearest the outer edge of the passenger car has welded to one end a tension rod pivot block, Part No. 7, to which is attached the adjustable tension rod, Part No. 3. The threaded lower end of this rod passes through a hole in the motor clip, Part No. 2. An examination of this part on Fig. 3 shows that by tightening this bolt the motor is caused to rotate around the pivot increasing the center distance between the motor pulley and the driven pulley on the compressor thereby tightening the belt. It is obvious, therefore, that through this device a service man may adjust the belt on this drive to the proper tension in a matter of a few seconds while the railway passenger car is stopped at a station.

The motor may be quickly removed for servicing by withdrawing the motor support pivot rod cotter pin, Part

Fig. 2 (Right)

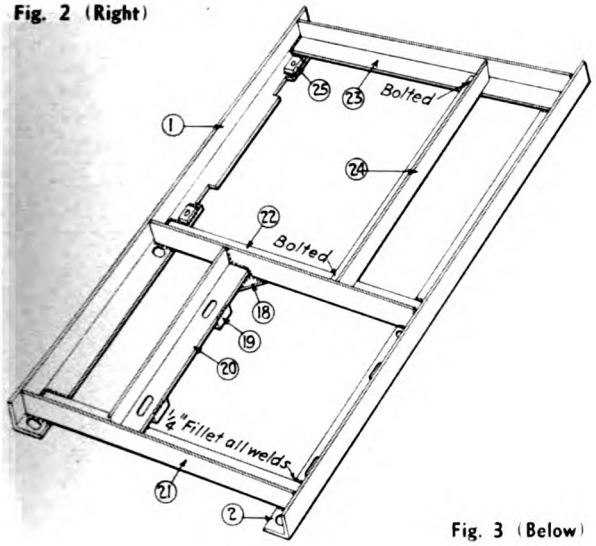


Fig. 3 (Below)

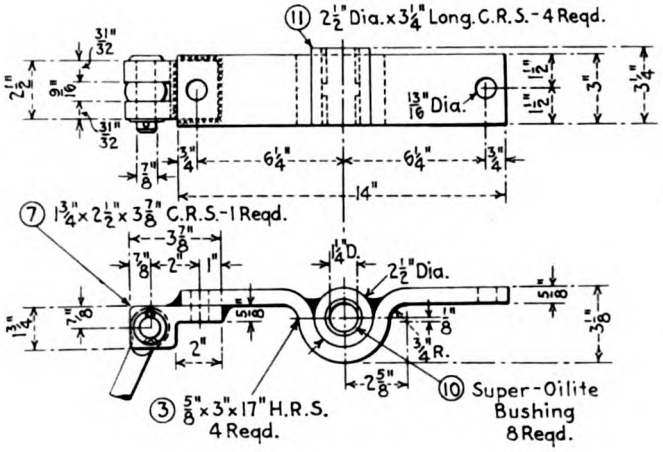
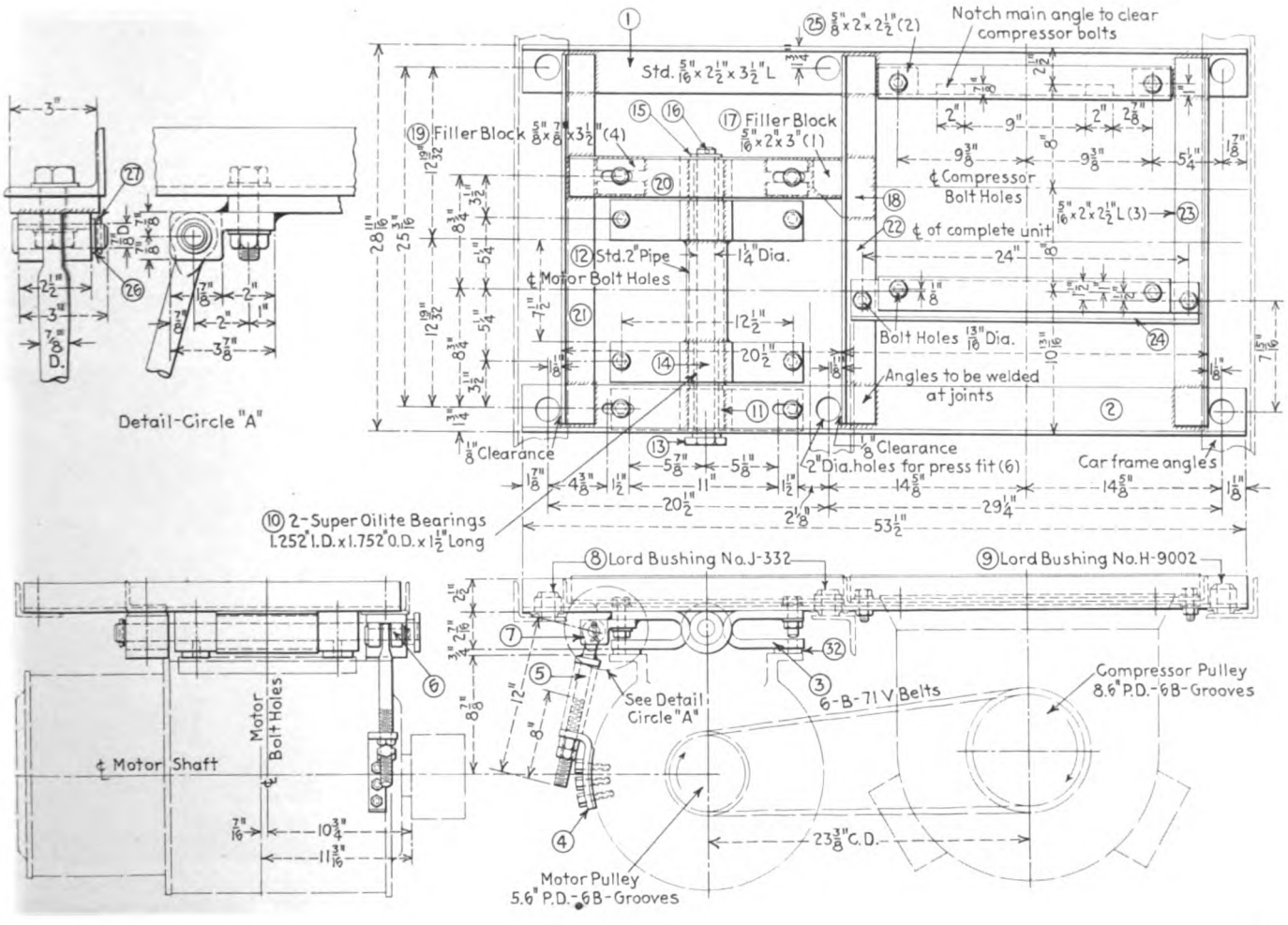


Fig. 4



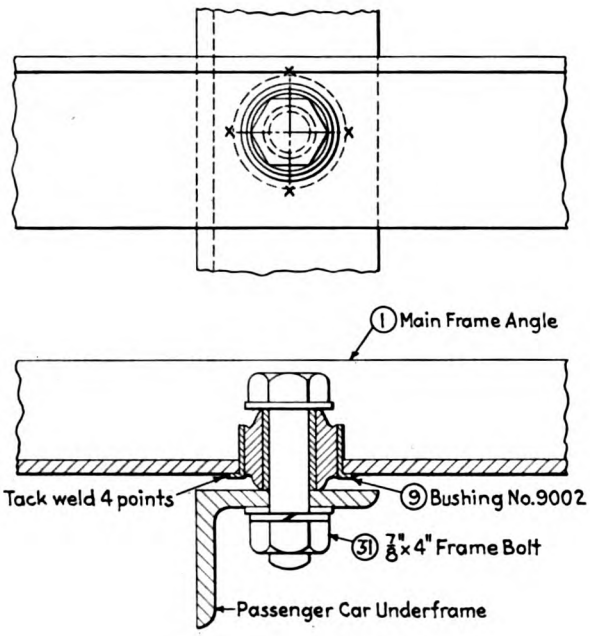


Fig. 5

No. 16; withdrawing the motor support pivot rod, Part No. 14; lowering the motor (to which two of the motor arms are attached) on to a dolly previously placed underneath; and removing the motor to the repair shop. The serviced or new motor may be replaced by carrying out the above operations in reverse order.

The three cross angle irons, Parts Nos. 21, 22 and 23, of the upper frame are designed to rest on the horizontal legs of the longitudinal angles, Parts Nos. 1 and 2, and be securely arc welded together to meet the requirements of positive connections insisted on by the railroad engineers. The six ⅞-in. bolts fastening the upper frame of the suspension to the underframe of the passenger car pass through tubular rubber mountings, as shown in detail in Fig. 5. The function of these mountings is to absorb the shock existing in all railroad rolling equipment, and also to prevent vibrations caused by the operation of the compressor from being carried into the body of the railway passenger car. Figure 3 shows slotted holes in Parts Nos. 2 and 20. These are for the four bolts fastening the motor arms, Parts Nos. 3, to the upper frame, and provide adjustment for belt alinement between the motor and the compressor.

The following is a complete parts list of the arc welded design:

Part No.	Description	Number Required
1	Main frame angle (compressor side)	1
2	Main frame angle (motor support side)	1
3	Motor arms	4
4	Motor clip	1
5	Adjustable tension rod	1
6	Tension rod pivot pin	1
7	Tension rod pivot block	1
8	Lord bushing #J-332	4
9	Lord bushing #H-9002	2
10	Super-Oilite bearings #S-1701-S	8
11	Bearing retainer 2½ in. diameter by 3½ in. long. C.R.S.	4
12	2-in. pipe spacer	1
13	Motor support pivot rod end cap	1
14	Motor support pivot rod	1
15	Motor support pivot rod washer	1
16	Motor support pivot rod cotter pin	1
17	Filler block 5/16 in. by 2 in. by 3 in. H.R.S.	1
18	Gusset plate	1
19	Motor arm spacer blocks ⅝ in. by ⅞ in. by 3½ in. H.R.S.	4
20	Intermediate angle, motor arm support	1
21	Motor end cross angle 5/16 in. by 2 in. by 2½ in. by 27¼ in. angle	1
22	Intermediate cross angle 5/16 in. by 2 in. by 2½ in. by 27¼ in. angle	1
23	Compressor end cross angle 5/16 in. by 2 in. by 2½ in. by 27¼ in. angle	1
24	Intermediate compressor angle 5/16 in. by 2 in. by 3 in. by 25¾ in. angle	1
25	Compressor spacer blocks ⅝ in. by 2 in. by 2½ in. H.R.S.	2
26	Tension rod pivot pin washer	1
27	Tension rod pivot pin cotter pin	1
28	¾-in. by 2-in. bolts and nuts with lock washers	2
29	¾-in. by 3½-in. Hi-Tensile bolts and nuts	8
30	⅞-in. tension rod nuts	3
31	⅞-in. by 4-in. frame bolts and nuts	6
32	¾-in. by 2-in. by 2-in. spacer blocks H.R.S.	4
33	⅞-in. by 2-in. by 2-in. tapered washers, malleable iron	4
34	¾-in. by 2½-in. bolts and nuts with lock washers	4

(The remainder of the prize paper includes detailed design and cost data which show how the suspension described is better than one of riveted construction and calculates the cost of the welded suspension when made in quantity.)

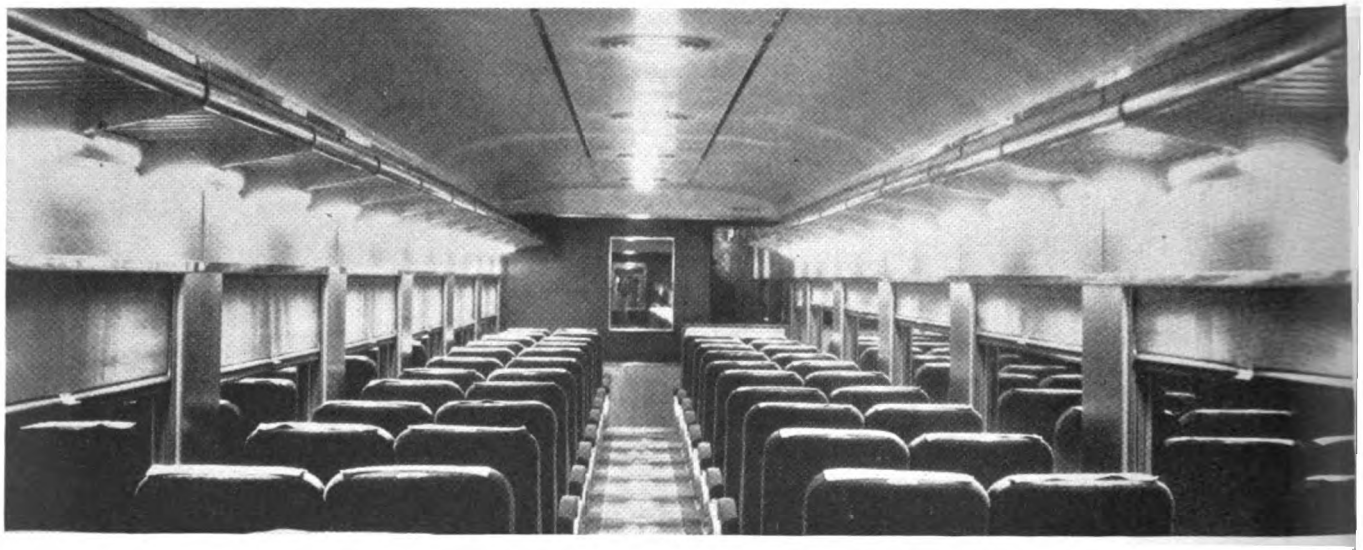


Fig. 6—Interior of a passenger car equipped with step-modulated air conditioning

ALL UP IN THE AIR

By Walt Wyre



The peep went places in high where a goat would have to go in low. . .

It would be disclosing a military secret to say that the weather delayed work on the army air field near Plainville and prevented the contractors finishing the job as scheduled, but any one that chanced to be in the vicinity could not help seeing trucks loaded with lumber and other material mired in the mud and even a Class F mental could tell that a building sans sides or roof isn't quite complete.

Finished or not, the soldiers began to arrive on the designated date and that's where the story starts.

Captain Scott, post engineer for the field, arrived in Plainville about three weeks before the field was to be occupied to organize his maintenance force and see that at least a portion of the buildings were in readiness for the troops.

Working through the local U. S. Employment office, Captain Scott employed three stenographers, opened up a temporary office, and let it be known that mechanics and laborers of many and varied classifications were needed. In his search for skilled men, he followed the example of the old maid that started out praying for a man, tall, dark, handsome, and wealthy and ended up just asking for a man.

Civil Service salaries are not sufficiently attractive to lure mechanics from construction jobs even with prospects of a steadier job with vacations with pay and sick leave. The Captain did manage to find a competent carpenter who accepted the senior job because his home is in Plainville and he didn't want to leave. He also found a plumber who was forced to go out of business in a small town nearby because in the town, which had no defense project, material was almost unavailable.

Several electricians, would-be and otherwise, asked Captain Scott about jobs. The salary mentioned discouraged most of them and qualifications required bluffed others. "The chief electrician must understand maintenance of motors, automatic controls, inside and outside wiring, both high and low voltage, and should be familiar

with refrigeration," the captain told the first few that inquired about the job. After the first few days there were no more inquiries.

About ten days before the date troops were scheduled to begin to arrive, the post engineer and his chief engineer went to inspect the headquarters building, a mess hall, the telephone building, and a block of barracks that were, according to the contractor, ready for use with perhaps a few small jobs that would be taken care of. Here are a few of the conditions the engineer found: Wiring was complete in headquarters, but the lights wouldn't burn; only one of the two refrigerating machines in the mess hall would run and the branch circuit panel had not been received, all circuits were temporarily connected through the entrance switch and a hundred and one other odd jobs, one or more in almost every building.

"WE must have a chief electrician," Captain Scott said, "and at least one junior electrician. See if you can't find one," he told the chief engineer.

Some one told the chief engineer that Ned Sparks, electrician for the S. P. & W., might be persuaded to take the job. Captain Scott called Sparks by phone and asked him if he would accept.

"I might," Sparks said, "if I could do it without losing my rights on the railroad. I'll be needing a job after this thing is finished. I'll come over and talk to you," Sparks added.

"Several people have told me that you are well qualified for the job as chief electrician," Captain Scott told Sparks.

"Well," Sparks replied, "I don't know about that. I've been keeping some other electricians off at least one job about thirty years."

"There doesn't seem to be any other electrician in this case," the captain said, "and we really need one."

"It's like I told you over the phone," Sparks said. "I wouldn't mind taking the job if I could protect my seniority on the railroad."

"How soon could you start?"

"Oh, in about fifteen days."

"O. K.," the captain said, "I'll write a letter to the railroad company and request them to release you, at least long enough for us to get some one else. I believe they will do it."

Next day Sparks talked to H. H. Carter, master mechanic on the Plains Division. "The railroad has to keep running, too, or else the army can't get where they need to go and wouldn't have anything to use when they got there," Carter said. "They have already hired half my laborers, two machinists, and several helpers without asking. I can't say whether the company will give you leave of absence or not, but they might if the army requests it through proper channels. When were you figuring on going to work out there?"

"Well, I was figuring on going in about two weeks. That would give me time to get everything pretty well lined up here. The other electricians should be able to keep things going and if you need any help Captain Scott said I could come any time."

"We can manage somehow," the master mechanic said, "but I don't see how if defense jobs and the army keep taking our men. Anyway, tell Captain Scott that if it isn't settled about you getting leave by the time you are supposed to go to work, you can go ahead and help him out at least while we are waiting to hear."

THE matter had not been settled two weeks later when Sparks reported to the post engineer at the air field. "You are just in time," the post engineer said as he picked up a map big enough for a tablecloth. "These buildings I have marked are to be ready for use tomorrow. Check all of the electrical equipment and put bulbs in all sockets. The chief engineer will let you have a couple of men to help put the light bulbs in, and whatever you do, see that the officer in charge of each building signs for the bulbs in it."

The "light bulbs" (lamps) were issued to the electrician from the storeroom on a memorandum receipt. The storekeeper would give Sparks the receipt in return for tally out sheets signed by an officer for the bulbs.

The chief engineer gave Sparks a specification sheet showing the size and number of lamps to be used in each type of building. He also let him have two men to help as the Post engineer had promised.

Sparks worked out a system for the job. The two men were to put in lamps while the electrician checked any other electrical equipment and kept track of the lamps. But the system didn't provide any method of locating the officer that was to sign the tally out sheet or getting him to sign after he was found. Invariably the non-com in charge, usually an old timer well versed in the art of passing the buck, not only for himself but for his commanding officer, would say "Lt. Blank just stepped out, leave the tally out sheet and he'll sign it when he comes in" or something similar.

At noon Sparks reported to the chief engineer. "Bulbs in all barracks in block twenty-three except some of them don't have all the sockets hung and the refrigerating machine won't run in the mess hall. The mess sergeant said he was expecting a lot of meat this afternoon," Sparks added.

"Did you get all of the bulbs signed for?" the engineer asked.

"No, I couldn't find the officers."

"Well, the first thing this afternoon, get all the bulbs signed for," the engineer said, "and don't leave any more that are not signed for."

"What about the refrigerating machine?" Sparks wanted to know.

"See about it as soon as you get the tally out sheets for the bulbs signed."

After lunch Sparks went back to block twenty-three. "No, Lt. Blank hasn't returned, but I'll see that he signs as soon as he returns," the sergeant at the first barracks told him and it was the same at each of the others.

By two-thirty Sparks was so disgusted he was about ready to go tell the post engineer to tie the job up in a nice long piece of red tape and ram it in a rathole.

"What are you going to do now?" one of the men helping the electrician on the job asked.

"Take the damned bulbs out and take them back to the storeroom," Sparks snapped. "Start in at the first barracks."

"Hey, what's the idea?" the sergeant in charge wanted to know when the two men started screwing the light bulbs out.

"From now on I'm not putting in any bulbs until *after* they are signed for," Sparks said.

"Wait a minute, I'll see if I can find the Lieutenant," the sergeant said.

"I'll wait just five minutes," Sparks snapped, "and if I have to take the bulbs out, somebody else can put them back."

The sergeant dashed out the door and returned in less than five minutes. The lieutenant is coming right over," he said.

"Go down the line to the other buildings," Sparks told his two helpers, "and tell the non-com in charge that if

the tally out sheets are not signed when I get there, we'll take the bulbs out."

"What's all the fuss about signing for a few light bulbs?" Lt. Blank asked angrily, "and what's this about *taking* them out?"

"That's correct," Sparks replied. "That's my order and you should know what an order means."

"O. K.," the lieutenant grinned. "Light bulbs have a habit of disappearing and nobody likes to sign for them. Wish you would put an outlet by the desk for a desk light when you have time."

IT didn't take long for word to get around that the new chief electrician wouldn't leave light bulbs that weren't signed for and that ended most of the trouble of that kind.

About four o'clock Sparks went to the mess hall to see what was wrong with the refrigerating machine that wouldn't run. The motor, three-phase two-twenty volt, hummed as though on single phase when turned on. Sparks fixed up a test light using two sockets in series and tested the lines. On one phase the two 110-volt lamps were normally bright but only glowed red on the other two.

The chief engineer came in while Sparks was testing. "What seems to be the trouble?" he asked.

"Looks like low voltage on two phases," Sparks told him. "Maybe a transformer fuse blown."

"The linemen changed a transformer on the pole outside yesterday," the mess sergeant who was watching and listening said.

That gave Sparks a clue and he went outside to look at the transformer connections. He had considerable difficulty figuring out just how the transformers were connected at first. It is a Y system with a common ground as used by the R. E. A. He finally figured that when the transformers were changed,—a new pole had been set also which necessitated changing all secondary connections,—that the lineman had by mistake connected one of the three phase wires to the neutral of the 110/220 lighting circuit.

"I'll go tell the line construction foreman," the engineer said. "That's his trouble until we take it over. You go over to the hospital and see what the trouble is there. They are opening part of it and Major Johnson phoned that he wanted an electrician right away."

"OUR X-ray machine just came in," Major Johnson, the chief medical officer, told Sparks and the man that came to install it says the wires are too small. I have an extension telephone I'd like to have connected and there's something wrong with the lights in my office."

"I'll see about the wires to the X-ray machine and the lights, but I don't know about the telephone."

"Oh, it's not much of a job to connect the telephone. It's a brand new desk set the signal officer let me have. He said it wouldn't be much trouble to connect it." The major turned and left before Sparks could explain that he had only recently learned to operate a dial telephone and his experience with the other kind had been limited to talking a little and listening a lot.

Trouble with the lights in the office was soon located. The days being chilly, someone had brought in an electric heater that took 20-amps. and had blown the 15-amp. fuse plugs. Sparks then went into the X-ray room. He found a man in charge with three soldiers setting up the machine.

"You see the specifications call for number four wire," the X-ray man said, "and the wire to the switch is only number 6."

"I imagine that's up to the electrical contractor," Sparks said. "I'll see what the post engineer says about it and let you know in the morning." And so ended Sparks' first day at the air field. It was nearly two hours past quitting time when he reached the office, so tired his rear end was close to the ground as a daschund's belly.

Next morning the post engineer told him to go ahead and connect the telephone and to see the electrical contractor about the wiring to the X-ray machine. The contractor sent one of his foremen with Sparks to see about the wire.

"We didn't have any No. 4 wire when that was run," the foreman said, "and I figured six would be O. K. If we have to put in four, we'll have to run new conduit."

"How long will that take?" the X-ray expert asked.

"Oh, it might be three or four days," the foreman told him. "We've got a lot of work finishing up buildings that are to be used right away, and I'm not sure we've got any No. 4 wire."

While the two were talking, Sparks was examining the machine and particularly the electrical connections. He noticed that while there were three wires coming to the entrance switch, the X-ray machine only showed connections for two wires.

"Do you need 110 volts and 220 both?" he asked the expert.

"No, it is 220. Why?"

"Tell you in a minute." Sparks went outside and checked to be sure the machine was on a separate circuit, then back to the X-ray room.

"You don't need the neutral wire," Sparks told the electrical foreman. "Why can't you pull it out and pull in two eights and parallel an eight and a six for the two-wire circuit?"

The electrical foreman and the X-ray expert stood a moment looking at each other, then the foreman said, "That would give plenty capacity, a little more than two four's would."

"Well," the X-ray man squinted one eye as though aiming a gun, "I guess that would be O. K. All I want is to be sure the voltage drop isn't excessive."

"Buy you a drink the first time I see you in town," the electrical foreman said to Sparks as he left.

THE next thing on the program was the extension telephone. Sparks went into the office to see what it looked like. It was a desk set without the ringer, just the combination receiver and transmitter and the cradle, when Sparks saw the dial on the cradle he knew he didn't even know how to start connecting the phone. But looking at it wouldn't help, so he headed back to the storeroom and got fifty feet of twisted pair wire and some insulated staples and returned to the hospital.

He ran the wire; that didn't take long, then started trying to figure out how to connect them. He connected the two wires to the two that came into the phone that was already in service, then by the trial and error method started figuring how to connect the extension. He would connect to two binding posts, then try the phone. He kept that up until the operator had a "go to hell" tone of voice when she said number, without the please.

At last Sparks managed to get the wires properly connected so the extension would work, but of course lacking a bell it wouldn't ring. Sparks explained it to Major Johnson.

"That's fine," the major said. "I wouldn't want it ringing in here all the time. A buzzer with a push but-

(Continued on page 59)

Correcting Overloads on Conductors

A feeder of the largest size possible to pull into a conduit is heavily overloaded and it is feared that the code rubber insulation is deteriorating rapidly. To replace the conduit which is buried below a concrete floor will be costly and interfere with production. What is the most economical way of correcting this condition?

Practical Things to Consider

Since any permanent correction of this condition likely will require apparatus and materials available only after long delay, if it is really feared the insulation is being damaged by excessive heating of the conductors, I suggest taking immediate steps to reduce the conductor and insulation temperature. This might be accomplished in two ways: namely, by installing a temporary, alternate or parallel circuit or by cooling the present circuit. An alternate of parallel circuit might be installed on timbers or it might consist of conductors or a cable laid on or just under the ground surface, carried over walks, roads, etc., protected by wood guards or by steel arches and run under rails between ties. Cooling of the present circuit might be accomplished by flowing water through the raceway or by creating a flow of air through it, using a blower or a compressed air jet. I recommend the use of water when practicable. An air flow induced by a compressed air jet may result in condensation in the raceway. If condensation fills the raceway at some point, pressure will be required to continue the air flow and care should be exercised if air is to be used under pressure. A pipe tee and nipple slipped over the circuit conductors and the nipple sealed will permit introducing water or air into the raceway through the side opening in the tee. Using water, if the two ends of the raceway do not differ in elevation sufficiently to provide an adequate flow, I would recommend piping from the side opening of the tee to an elevated funnel or discharge cone. This will permit using water under a fixed head rather than under pressure. It will be found a small flow of water is adequate. Although the above suggestions are unconventional, they will accomplish the desired results. Their use may be considered warranted to avoid failure of a vital circuit and to avoid ruining critically scarce conductor copper and rubber insulation.

Following are some permissible permanent solutions that may be used individually or in combination, depending on circumstances and the existing conditions:

(1) Assuming this is an alternating-current circuit, if it feeds a low power-factor load, power-factor corrective measures may relieve—and perhaps even completely correct—the condition. Since power-factor corrective measures have been presented in previous issues of this magazine, since they may be investigated by studying manufacturers' application data and reference works, and since manufacturers' engineers may be "called in" or consulting engineers retained, and because even a brief resume of available methods would lengthen this answer unduly, I shall not include any suggestions as to how power-factor can be corrected. I do desire to point out that, if underloaded motors are causing the trouble, corrective measures should include consideration of exchanging motors to more fully load the motors finally applied.

(2) If it is possible to measure or estimate the conductor and insulation temperatures at the hottest point, it then can be determined whether there is available a conductor insulation suitable for operation at that temperature. If so, conductors of the same size insulated therewith might be installed in lieu of the present conductors. If the hot-spot temperature is an unknown, reference to manufacturers' data on maximum current-carrying capacities of conductors with various insulations under the conditions obtaining in this installation will indicate what benefits may be anticipated if a different insulation is used. Since the overloading is severe, it likely will be necessary to use this scheme in conjunction with one of the others to completely correct the condition.

(3) There are several possible solutions involving use of a higher voltage. I shall separate these into two general classes: (a) If the circuit operates at 240 volts or less, the condition might be corrected by operating the circuit at 480 or 600 volts. If the present voltage is 480, although changing to 600 volts may relieve the condition, a complete correction likely will necessitate using this method in conjunction with one of the other schemes. Changing to a higher secondary voltage will require either reconnection of the transformer secondary leads feeding the circuit or replacement or installation of transformers. It also will require transformers at the load end of the feeder circuit unless the load can be reconnected readily to operate at the higher voltage. If the latter course is pursued, it will require replacement of distribution panels, circuit disconnecting means, overcurrent protective devices, controls, etc., with similar apparatus having the higher voltage rating. Considering the apparatus and materials required for such a change, if there are many utilization devices the use of transformers at the load end of the circuit no doubt will prove simpler, cheaper and a quicker solution. Additional disconnecting means and overcurrent protective devices probably will be required if the voltage of the circuit is increased. (b) If the circuit operates at 600

Can you answer one or more of the following listed questions? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Editor, *Railway Mechanical Engineer*, 30 Church Street, New York, N. Y. Answers to the following questions should be sent in not later than the 15th of February.

Some time ago we installed a conduit system in an enginehouse which we tried to make as tight (moisture-proof and vapor-proof) as possible. As soon as cold weather came on, all the low places filled with water and we had to drill holes to let the water out. What is the best way to take care of a situation like this?

What can I do to get the best service and longest life from the evaporators and condensers in our air-conditioned cars?

What is the best and easiest way to find whether an oxide-film rectifier is shorted or operating properly?

volts or less, changing the circuit to 2400 or 4150 volts or to primary distribution voltage might be advisable. This will require replacing the present conductors with conductors having high voltage insulation. The circuit then may be connected to the primary distribution system or to a transformer installed to provide the higher voltage. This change will require a transformer at the load end of the feeder circuit for reduction of the circuit voltage to utilization voltage. Also, the installation of additional disconnecting means and overcurrent protective devices in the primary and secondary circuits may advisable.

Transformers used in connection with the changes suggested under (3) should be non-inflammable, liquid-filled or air-cooled, agreeable with National Electrical Code and other Standards, if they are mounted within or adjacent to buildings.

Although the inquirer requested the most economical solution of the problem, the general statement thereof demands a general answer. It does not permit an analysis of the economy of the solutions suggested. I have listed, therefore, the more likely methods that might be applicable in relieving or correcting the condition. The inquirer should estimate the cost of each applicable scheme or combination of schemes that will correct his conditions as they actually exist. The proper procedure then may be determined on the basis of those data evaluated against estimates of energy losses and maintenance expense for each solution and of the anticipated future load growth, etc. The final choice will have to be adjusted to the availability of the apparatus and materials required for each solution that will correct the condition.

P. O. LAUTZ,
Electrical assistant,
Atchison, Topeka & Santa Fe Ry. Co.

Before Making Corrections, Look for Faults

The fact that a feeder is overloaded may not be due to faulty conditions, but it seems reasonable to look for trouble whenever any electrical equipment is overloaded.

If the circuit feeds induction motors or fluorescent lamps, the trouble may be traced to a poor power factor. Capacitors will correct this condition. If the load is unbalanced, the thing needed is a careful balancing. In this connection, it is well to remember that induction motors pull unbalanced loads if coils have been cut out of some of the phase windings. Also, motors often pull excessive loads due to mechanical trouble on the driven machine. A careful check of gear alinement, lubrication, condition of cutting tools, bearings, etc., should clear the slate of most mechanical ills. It also might be well to look for grounded equipment. Two separate grounds located in different parts of the same shop can cause strange circulating currents. Grounded conductors will usually show up by the blowing of fuses or the opening of circuit breakers, but grounds in motor windings may go undetected for long periods unless a special effort is made to find the trouble.

If the overload cannot be decreased by the elimination of trouble, then it will be necessary to take other steps. Wire with special heat resistant insulation could be installed, or wire with thin insulation might be considered. The latter will allow a greater amount of copper in the same sized conduit, and thus might reduce the heating.

If, due to war conditions, it is impossible to obtain special wire, then it may be necessary to resort to some makeshift arrangement. Under this heading might be considered the use of an air blast directed down the conduit to keep the wires cool. If the circuit is of the two-wire direct-current type, then the two wires in the conduit could be paralleled to provide the positive leg of the circuit, while the negative leg is carried through building steel, or through bonded rails located in the vicinity. If this last method is used proper care should be taken to avoid electrolysis due to leakage from the return path.

FORD C. PETHICK,
Assistant electrical supervisor
Delaware, Lackawanna & Western

Six Ways to Reduce the Temperature

(1) Overheating of the feeder may be caused by low power factor. Check with instruments for power factor of feeder and of principal loads that may be causing the low power factor. Connect capacitors at or near the loads that are causing the trouble. Aim to get 0.90 or 0.95 power factor. If the feeder tests 0.90 p.f. or better, capacitors will be of little help.

(2) Investigate the loads on this feeder and on other feeders. Perhaps some load can be transferred to some feeder which is underloaded and which has high power factor. This may involve moving the driven equipment or installing long conductors to reach the other feeder.

(3) Investigate the larger induction motors if there are any on this feeder. A unity p.f. or 0.80 leading p.f. synchronous motor or two may be substituted. This latter expedient will have a double effect—it eliminates the lagging reactive kva. caused by the induction motor and adds leading reactive kva. from the synchronous motor.

(4) If the power factor is good, then perhaps the voltage may be stepped up, say 15 per cent, by auto-transformer with consequent reduction in current and heating. If the connected load will not stand the voltage increase, a step-down transformer at the other end will restore voltage to normal at the loads.

(5) See if some loads can be transferred to night operation or to some other off peak time so as to reduce the feeder load.

(6) A power company has reduced heating successfully by running city water through conduits certain hours of the day when heating runs highest.

R. H. ROGERS,
Industrial Engineering Department
General Electric Company

Examine the Load and Maintain Voltage

In plants where the national emergency has taxed all available equipment and supply systems beyond limits expected at the time of the original installation, means must be devised to utilize as much as possible the existing facilities in meeting the increased production demands. In raising the supply capacity of feeders and generating units, it is important to keep at a minimum the use of additional material and labor which may be utilized to better advantage in the various war industries for the successful prosecution of the war.

Staggering of Heavy Loads.—Periodic overloads on supply feeders may be reduced by a systematic staggering of the heavier loads according to a prearranged

time schedule. Some machine operations requiring heavy currents may be performed on different shifts in shops where two or three shift work is in effect.

Improving Drives.—The normal operating conditions of all motors should be checked and compared with their rated output. Much needed feeder capacity may be made available by rearranging motors so as to operate them near their maximum efficiency. In making these changes, it is necessary to bear in mind that of two motors of the same rated output, the motor with the higher rated speed has usually the higher efficiency. Also, the speed regulation of a driven machine is in most cases more efficient, if not more convenient, than the speed regulation of the driving motor.

Maintaining Rated Voltage.—When induction motor load constitutes the major part of a combined power and lighting load, more cable capacity may be made available by maintaining rated voltage at the load or even by raising the delivered voltage a few per cent above rated voltage. If lighting is on a separate system, the supply voltage to electric motors may be raised to 10 per cent above the rated voltage. Under these conditions, primary and secondary currents will be lower for any given load. While magnetizing current and core losses will be somewhat higher, these losses will be more than compensated for by the decrease in primary and secondary copper losses resulting in a slightly higher efficiency. The starting and pull-out torques will be increased about 20 per cent. Friction and windage losses will not be affected.

A terminal voltage of 10 per cent lower than rated voltage has a much greater effect on the full load current, torque and temperature rise of a. c. motors than it has on their speed. In d. c. motors, a 10 per cent voltage drop has little effect on the temperature rise but causes the full load current to be almost 12 per cent higher and thus puts an undue load on the supply feeder. A 1 per cent drop in incandescent lighting voltage causes a reduction of about 1.5 per cent in lighting load but a loss of almost 3 per cent in lumens illumination. Although the effect of voltage drop on fluorescent lighting is relatively less, this type of lighting may fail completely at an undervoltage exceeding 10 per cent.

Improving Lighting System.—The load on the feeders may also be reduced by using fluorescent lighting which has a higher lumen output per watt. Intelligent location of outlets and better cleaning of lighting fixtures may allow a more economical system of lighting.

Improving Power Factor.—In electric power applications where induction motors constitute the major part of the load, there is a possibility of improving the system power factor and thereby reducing the line current in the feeder for a given amount of energy consumed. Power factor may be improved to the most economical percentage through the use of synchronous or static condensers or synchronous motors operated at a suitable power factor partly for one of the larger drives and partly for the supply of leading current.

Transformers whose secondaries are not supplying any load should be kept disconnected from the line. Underloaded motors and transformers should be replaced by others of proper size operating nearer their maximum power factor. In applying motors to specific drives, higher speed motors which operate at higher power factor and efficiency should be given preference. This may be made possible by the use of higher ratios of speed transformation or by the use of gearmotors.

Increasing Size of Conductors.—It is sometimes possible to replace the feeders with heavier ones of standard insulation thickness. When this replacement is not possible, more copper cross-section can be pulled into the existing conduit by using new type thin insulation wires or cables. If other feeders are available which as a result of the relocation of major production units have been underloaded, the feasibility of a multiple or ring bus system should be investigated.

Redetermine Load Centers.—When the added copper cross-section made available by the use of small diameter cables fails to meet the increased demand, a survey should be made of the distribution system so as to redetermine load centers, their magnitude and probable growth. If the feeder in question is long and the load which has outgrown its distribution system is beyond a possible solution by any of the foregoing methods, the use of transformers supplied at a higher voltage should be given consideration. A distribution panel should be provided in a central location of each load center.

General Maintenance.—It is the maintainer's duty to make periodic insulation resistance tests of the wiring system to determine any wasteful leakages and probable deterioration of conductor and electrical equipment insulations. The equipment should also be periodically inspected to avoid arcing contacts, loose connections, local heating in windings, mechanical difficulties in drive shafts and equipment which unnecessarily raise the energy consumption.

R. G. CAZANJIAN

And Don't Forget the Economics

There are several methods of correcting the condition mentioned in the question, but it is not possible to state any specific way which will be most economical in every case. The exact method which will prove to be the most economical can be determined only by a study of the relative costs of applying the several applicable methods discussed below. It will depend on the characteristics of the load and the cost of the material and labor required by the various ways which may be applied to obtain the desired result.

It may be possible to extend the useful life of the existing feeder by reducing the current being carried to a reasonable value, which the rubber insulation, in its present condition, or new wires of the same size and insulating material can carry without undue depreciation. This reduction of current may be obtained in several ways: (1) By transferring all or part of the load to a new line; (2) by transferring part of the load to other feeders in the vicinity which are not fully loaded; (3) by raising the voltage of the line to the upper limit of the insulation value of the conductors; (4) by power-factor improvement; (5) by use of heat-resistant insulation, and (6) by use of thin-wall insulation and larger copper.

The problem may be solved by working on another angle; that is, increasing the current-carrying capacity of the present conduit by scrapping the present feeder. It will probably be possible to install a new set of conductors with a current-carrying capacity sufficiently greater than the existing feeder, so that it will easily handle the present load and provide a reasonable margin for future additions. This may be done by (5) using the same size conductors but an insulation which will operate successfully at a higher temperature, or (6) by using larger conductors but thin-wall insulation so that the overall diameter is of such size that they will fit into the present conduit.

To determine the most economical way to do the job,

the cost of each method must be evaluated. Method 1 will require the construction of another underground or overhead line of such capacity that the load on the original line will be reduced to within reasonable current-carrying limits which will cause no further undue depreciation of the insulation. This scheme is feasible only if another route is available for running the relief line at reasonable cost and it is also possible to divide the load between both lines by splitting it into two blocks. It is never advisable to parallel two lines, whether they are of unequal or equal size, if they are run by different routes, as the shorter one will carry more than its normal portion of the current.

It is often possible to relieve loaded lines by redistribution of loads on all feeders in the vicinity. If this condition exists in the particular case under discussion, Method 2 can probably be applied with very little capital outlay. In this event, it is assumed, of course, that the total load consists of several separate branches or devices which can be reconnected to other feeders.

Method (3) may be applied where it is possible to install a step-up transformer at the point where the overloaded feeder connects to the main system, thereby raising the voltage and reducing the current of the entire feeder to some value which is within the safe operating voltage and current values of the depreciated insulation. At the load end of the line, it will be necessary to install a step-down transformer or reconnect the equipment which composes the load, if it is possible, for operation on the higher voltage. If this method is used with a fairly low voltage ratio between the original and the stepped-up lines, it probably will be more advantageous to use autotransformers which have a somewhat lower first cost and less operating losses.

A simple and economical way of reducing the current may be obtained by Method 4, power-factor improvement, which may be used if the line current is lagging to such an extent that its resistive component does not exceed the carrying capacity of the original conductors in their present condition. Under these circumstances, it is a relatively simple matter to install capacitors at the load to the extent necessary to reduce the lagging reactive component of the current, so that the line current falls to the desired value. For a further discussion of power-factor correction, see the Consulting Department, October issue of *Railway Electrical Engineer*.

The capacity of the line may be increased sufficiently by installing a new set of cables of the same conductor size, but with insulation suitable for operation at a higher temperature and, therefore, capable of carrying a greater current (Method 5). Since the original feeder has code grade rubber insulation (Type R), it may be replaced with heat-resistant rubber (Type RH), for example. Suppose that the original line operates at under 600 volts and consists of three No. 1 conductors in a 1½-in. conduit. The carrying capacity, according to the 1940 National Electrical Code, would be 91 amperes. By replacing with the same size cables, but with RH type insulation, capable of withstanding an operating temperature of 75 deg. C. instead of 50 deg. C., the permissible capacity is increased to 131 amp.

The application of Method 6 to the above-mentioned example will result in the use of a thin-wall type of insulation which will permit the use of a greater amount of copper in the existing conduit. Suppose the original feeder is removed and it is decided thin-wall synthetic insulation, type SN, which will withstand a maximum operating temperature of 60 deg. C. The largest size of wire with this insulation which the code permits to be installed in a 1½-in. pipe is three No. 000 cables. This feeder will then have an allowable current-carrying capacity of 166 amp. Hence, it may be noted that increases of 40 or 75 amp., 44 or 82.5 per cent, respectively, are available by replacing the original cables and still using the same conduit.

In summarizing, it might be noted that for short lines the cost of replacing the cables will generally work out to be most economical and can be done with a very small amount of labor. When the line is very long, a careful study of the other methods must be made, in addition, before the certainty of the cheapest way of doing the job can be established.

STANLEY A. KROLL,
Electrical Engineer.

All Up in the Air

(Continued from page 55)

ton at the desk in the outside office to signal me when I'm wanted on the phone will be O. K. You can get that in right away, can't you?"

As the days went by, the job at the air field began to run more smoothly. Ray Duncan, a young fellow that had a twisted foot and thus not eligible for military service, was hired as a junior electrician to help Sparks. Two enlisted men that had had some experience were temporarily assigned to help also. Tools that had been ordered for the electricians began to come in—pliers, all sizes, shapes, and kinds, all of the best; screwdrivers, Stillson wrenches, testing instruments—Sparks had forgotten that such things were to be had at all. He got quite a kick out of just handling the tools, but what he liked most was the jeep junior temporarily assigned for the electricians' use until delivery could be obtained. He thrilled at the power and pickup of the little peep that went places in high where a goat would have to go in low.

One thing that surprised Sparks a lot was the number of men that had left the railroad to work at the air field. Some of them had given up a good many years seniority and he began to wonder about his own. He was rather expecting and hoping that the railroad company would allow him to stay for the duration.

Despite the red tape incidental to all government enterprises and annoyance that are part of any job, he liked it. Then, perhaps because he was working with and around men in the service, Sparks felt that he was doing a job that was more a part of the war effort than railroading, although he knew that wasn't actually true. Railroad operation, as the master mechanic had reminded him, is just as much a part of the war effort as building planes or even flying them.

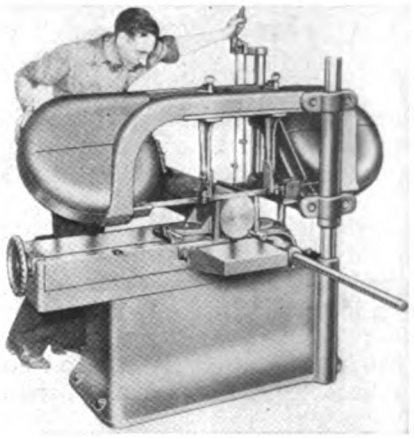
The day the new drill press and small lathe for the electric shop arrived at the air field, Sparks received a letter from the master mechanic stating that the request for his leave of absence to work as electrician at the air field had been refused and he must either report back to the railroad in forty-eight hours or forfeit his rights. His first reaction was to tell the railroad to go to Hades or some other seaport, but then on second thought he had many years seniority on the railroad and only thirty days at the air field, and railroads are essential too.

Carter was reasonable when Sparks reported. He allowed the electrician to work fifteen days more at the air field. Most of all Sparks hated to leave all those bright shiny new tools and the peep that didn't require a ration card for gas or tires.

NEW DEVICES

Large Metal-Cutting Band Saw

With a capacity for cutting 13-in. by 16-in. rectangular and 13-in. round stock, the new Model V-12 metal cutting band saw, recently developed by the Wells Manufacturing Corporation, Three Rivers, Mich., extends the advantages of continuous metal



Large Wells metal-cutting band saw

cutting to many larger jobs that previously could not be handled on small low-cost band saws. The V-12 incorporates the best features of Wells Models 5 and 8 machines and in addition offers a new hydraulic control feed and lift apparatus as well as several other developments.

The most radical departure from previous designs is in appearance. To provide the necessary ruggedness for the increased capacity, the frame has been completely redesigned.

The V-12 is equipped with a ¾-hp. electric motor which drives the blade at a choice of three speeds, 53, 94 or 148 ft. per min. Taking advantage of this choice of speeds, it is said that, with this machine, it is possible to cut almost any metal in almost any shape.

In size, the V-12 is 52½ in. in over-all height and requires a floor space of 73 in. by 30 in. The top of the bed measures 24 in. from the floor. The total weight of the saw is 1,750 lb. Other details of the saw include a hand-operated quick-acting vise, belt and gear drive and ball-bearing support of moving parts.

Stainless Steel Substitute

A non-magnetic manganese alloy, which can be substituted for stainless steel, has been announced by the General Electric Company, Schenectady, N. Y. The new alloy will free nickel, chromium and tin for other war uses. All three metals are listed by the War Production Board as "inadequate for war and most essential uses" while manganese, the substitution of which makes the saving possible, is available in greater quantities.

The new alloy replaces a formula which called for 18 per cent chromium, eight per cent nickel and the remainder iron. Either alloy requires a covering to permit soldering, and for the tin coating previously used, a lead coating has been substituted. Adequate supplies of lead are available.

Bars, rods and plates made of the new alloy are used in motor-generators for submarines, control equipment for planes and tanks, and in switchgear equipment and motors for war industry generally. Wire made of the alloy has sufficiently high strength to make it suitable for use as banding wire on the traction motors of electric locomotives.

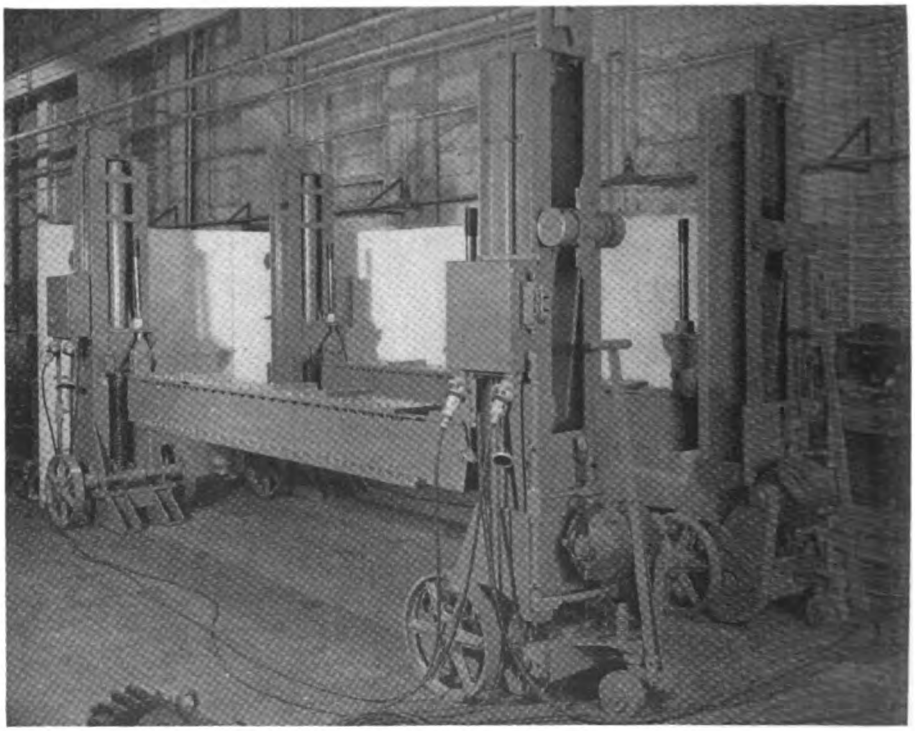
Lifting Jack and Elevating Dolly

Two recently developed tools for use in maintenance of steam and Diesel locomotives have been announced by the Whiting Corporation, Harvey, Ill. The first is a portable high-lift electric jack which has a capacity of 140 tons. The jack is suitable for indoor or outdoor use. It is so designed that narrow- and standard-gauge steam locomotives, Diesel-electric locomotives or passenger cars can be quickly raised and lowered. Slotted feet allow the beams on the jacks to be lowered below track level and the beams themselves can be removed to permit Diesel locomotives to be raised on the pads of the jack. Limit switches and other safety devices are built-in features of the jack.

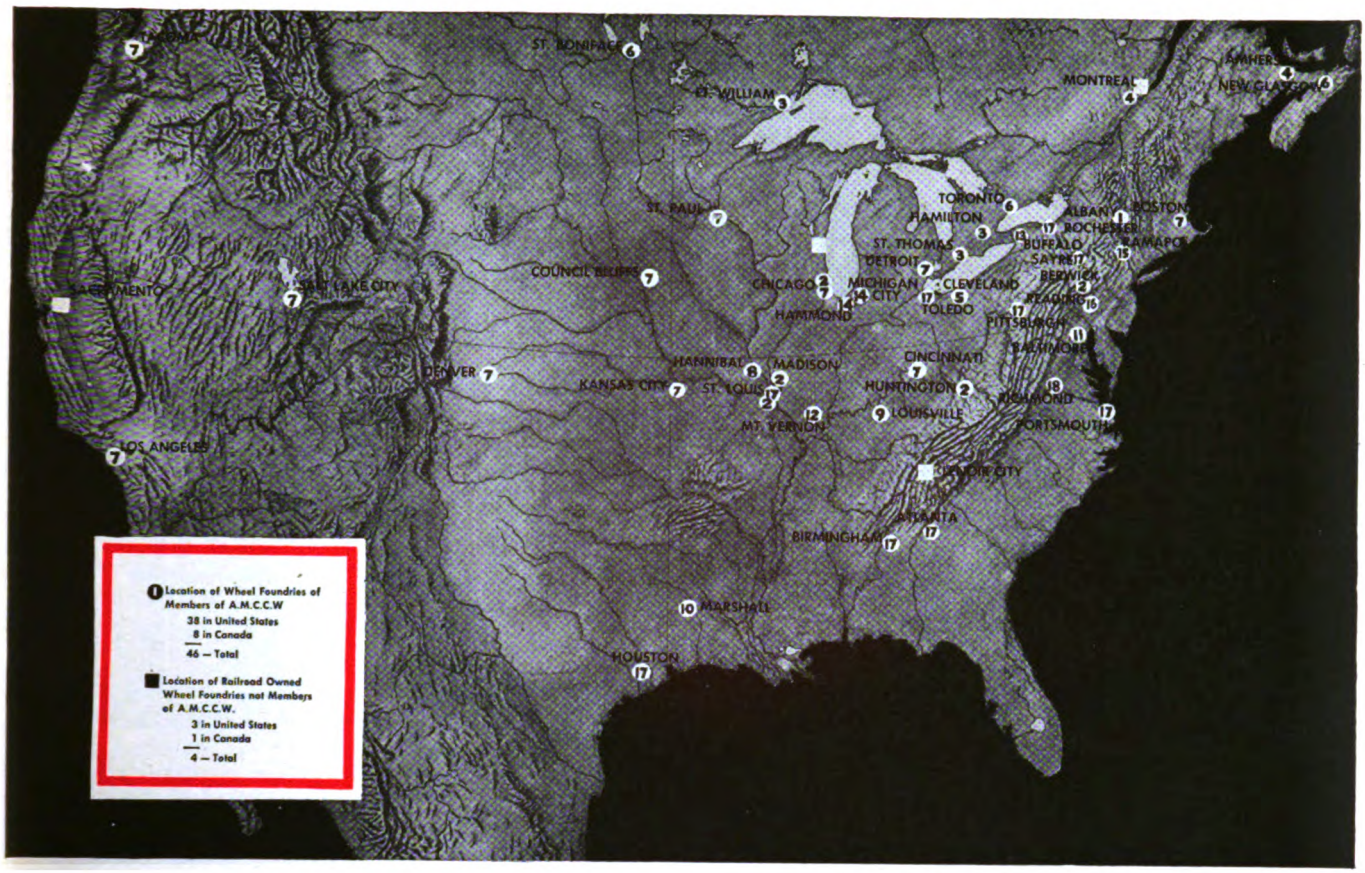
The second device is a four-wheeled dolly, equipped with an elevating mechanism, for removing mounted wheels and the motor assembly from Diesel-electric locomotives. The elevating arrangement is built with an adjustable tilting plate operated by a ratchet wrench from either side of the dolly. This plate is used to tilt the nose of the motor during wheeling or unwheeling operations.



Elevating dolly for use when removing or replacing wheels in Diesel-electric locomotive trucks



Electrically operated lift jack for use under standard and narrow-gauge steam locomotives, Diesel-electric locomotives and passenger cars



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PLANTS STRATEGICALLY LOCATED

to Better Serve All Railroads

Chilled Car Wheel plants are strategically located to provide the railroads quick and efficient service, reduced delivery charges and a handy market for scrap wheels.

Spot the dot on the map nearest to the point where you want delivery; then check the list of member manufacturers for the one to call on to best serve your requirements.

The membership of this association includes every manufacturer of Chilled Car Wheels in North America excepting railroad plants.

1 Albany Car Wheel Co.
2 American Car & Foundry Co.
3 Canada Iron Foundries, Ltd.
4 Canadian Car & Foundry Co.
5 Cleveland Production Co.
6 Dominion Wheel & Foundries, Ltd.
7 Griffin Wheel Company
8 Hannibal Car Wheel & Foundry Co.
9 Louisville Car Wheel & Railway Supply Co.
10 Marshall Car Wheel & Foundry Co.
11 Maryland Car Wheel Co.
12 Mt. Vernon Car Mfg. Co.
13 New York Car Wheel Co.
14 Pullman-Standard Car Mfg. Co.
15 Ramapo Foundry & Wheel Works
16 Reading Car Wheel Co.
17 Southern Wheel Division of the American Brake Shoe & Foundry Co.
18 Tredegar Iron Works

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
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3183

Glass Reflectors Save Aluminum

Using mirror glass reflectors with silver backing and cast iron hoods, the Westinghouse Lighting Division, Cleveland, Ohio, is producing improved yard lights and at the same time conserving war-needed aluminum. The new lights produce about 10 per cent more illumination.

There are two reasons for this increased efficiency. The mirror glass reflects more



One of the lighting units undergoing assembly

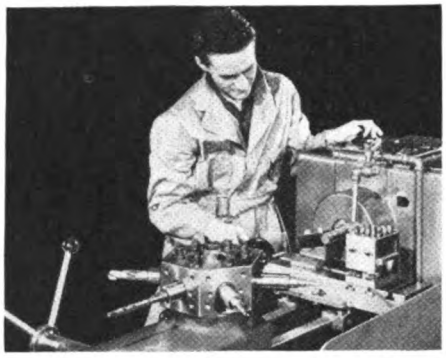
light than aluminum, and it extends below a globe clamping ring that formerly blocked off part of the reflected light.

Although the conversion of aluminum to war uses made it necessary for Westinghouse to substitute silvered glass reflectors, the new lights were so designed that the reflectors are interchangeable with the aluminum units. This makes it possible for war industries to renew old yard lights without buying complete units.

Turret Lathe With Automatic Indexing

Previously furnished with a manually controlled, six-station turret, the Oster No. 601 lathe is now equipped with automatic indexing. The machine, having a capacity of 1½ in. (round) for cutting-off, boring, tapping, reaming,. facing, threading, and for many other operations, is simplified in design and construction to meet requirements for low cost and easy operation. The simplicity of the machine recommends it for use in rapid and efficient training of new operators. Where three or fewer operations in sequence are required, the machine can be furnished with a plain saddle instead of the six-station turret.

Purchasers can specify a worm or direct drive to the spindle, a two-speed motor, reverse, or electric brake control. The motor connects by means of multiple V-belts and speed changes. On the worm-drive design the speed changes are obtained by the application of quick-change sheaves for 140



This six station turret lathe is equipped for automatic indexing

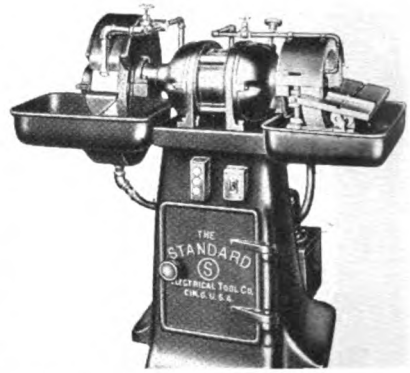
to 1,000 r.p.m. with a motor operating at 1,800-3,600 r.p.m., 70 to 500 r.p.m. with a 900-1,800 r.p.m. motor. On the direct-drive design speed changes range from 900 to 3,000 r.p.m. with an 1,800-3,600 r.p.m. motor and 450 to 1,500 r.p.m. with a 900-1,800 r.p.m. motor. The spindle is mounted on ball bearings. A belt-connected coolant pump is assembled in the machine base. The machine occupies 33 in. by 70 in. of floor space, without its far-feed extension, which requires 94 in. beyond the pan. The net weight of the machine is approximately 1,700 lb. These lathes are built by the Oster Manufacturing Company, Cleveland, Ohio.

Tube Cleaners for Locomotive Boilers

A complete series of fast operating cleaners for syphons, circulating tubes, arch tubes, branch pipes and automatic blowdown pipes are manufactured for locomotive boiler work by the Airetool Manufacturing Company, Springfield, Ohio. The various tools are operated by powerful motors and all wearing parts are made of alloy steels to give long life and lowered maintenance costs. The cleaners are equipped with newly designed non-tracking cutters to insure safety to the tube walls. Various types of heads can be obtained to widen the useful range of the tools.

Adjustable Table for Carbide Tool Grinder

A carbide tool grinder which has a table that is not only adjustable to angles with suitable graduations for the tool which is to be ground but which can also be adjusted to compensate for wheel wear is being produced by the Standard Electrical Tool Co., 1899 W. Eighth st., Cincinnati. It is equipped with a 3-hp., 1150-r.p.m. motor for use with a straight grinding wheel 18 in. in diameter by 2½ in. face for rough-



Wheel-wear compensation is a feature of this carbide tool grinder

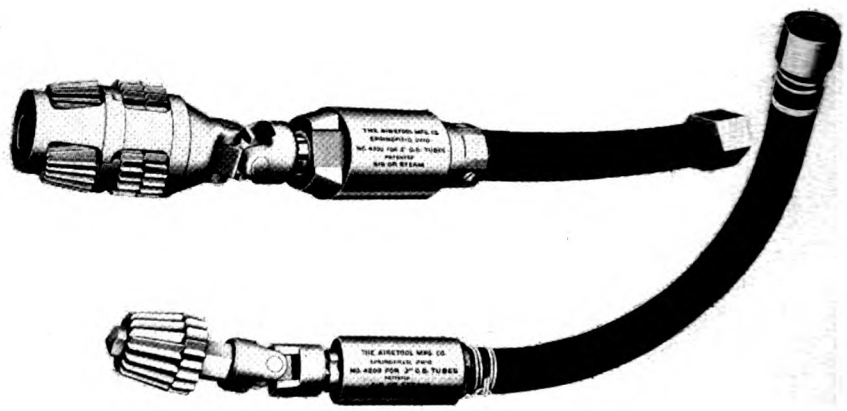
ing operations. Suitable flanges accommodate this size wheel with a 10-in. hole.

On the opposite end of the spindle is a steel plate which takes cylindrical wheels 14 in. in diameter for face or finish grinding. This has a wet grinding attachment and a separate toggle switch for controlling the motor-driven pump. The machine has a reversible motor. In addition to the size described, similar machines are available in 1 hp. 10-in. and 2 hp. 12-in. sizes.

Forced-Convection Heaters

Forced-convection electric heaters are now being made by the General Electric Com-

(*Continued on next left-hand page*)



Top: An arch-tube cleaner with an expansion type head—Where compound bends are encountered a swing-arm head is recommended for use with this tool—Bottom: Cleaner for scale removal in branch pipes

700,000 Items Of Equipment in U. S. Landing Force

Even Locomotives And Bridges Went With the AEF

The American force invading North Africa is so well equipped that even bridges and locomotives were landed with it, Robert P. Patterson, Undersecretary of War, last night told an audience of 1000 at a dinner of the Crowell-Publishing Co. at the Waldorf-Astoria.

Describing the operation as the

than 10,000 items, 68,000 items of supplies and drugs, 100,000 engineering corps items, including such things as bridges, bulldozers, well-digging equipment, storage tanks and railroad locomotives.

"There are 250,000 different ordnance items alone."

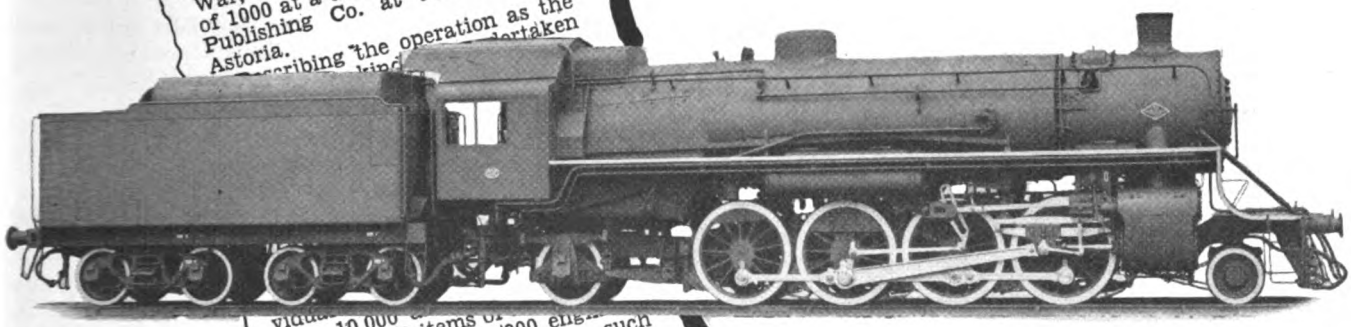
Mr. Patterson said that seven tons of shipping per man were required to land the expedition and a ton and a half per man will be needed to maintain supplies.

Ahead of Schedule.

He noted that the invaders were now only 400 miles from the heart of Italy and said that Mussolini would soon have more reason than ever to regret the famous "stab in the back."

He said that so far the expedition was moving ahead of schedule, that it had met less resistance than expected and that the French are clearly with us and against the Axis.

New York World-Telegram, Nov. 13, 1942



One of the 2-8-2 type locomotives built by Lima for the U. S. Army.

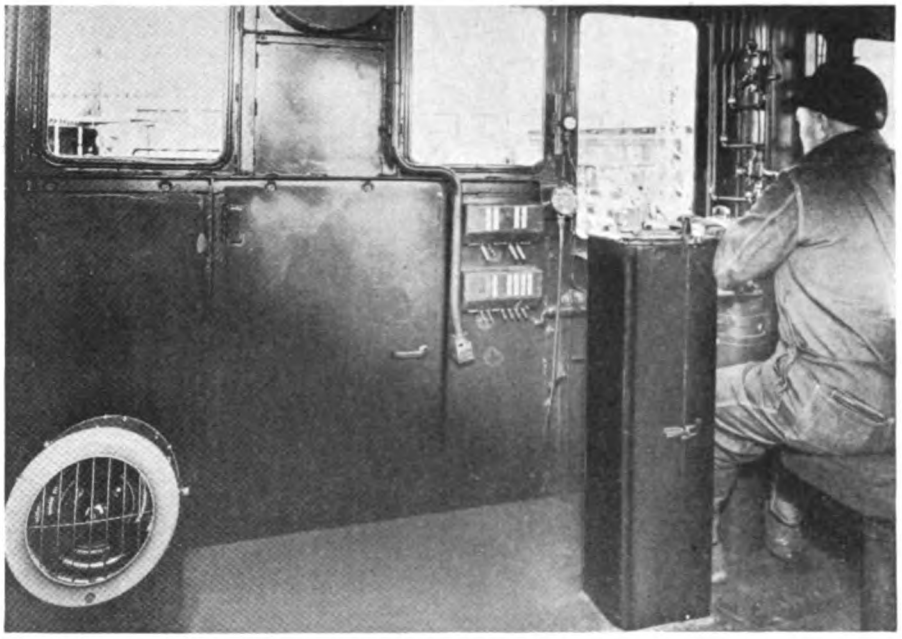
Steam locomotives are as essential to successful military operations as they are to peace-time commerce.

The Lima Locomotive Works, Inc., builder of all types of Modern Steam Locomotives for over 70 years, is supplying America's armies with locomotives of the 2-8-0 and 2-8-2 types, as well as 30-ton M-4 tanks, the famous "General Sherman's" of Libya and North Africa.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

pany, Schenectady, N. Y., for the cabs of electric locomotives, watchman's towers, substations, warehouses crane cabs and similar out-of-the-way places.

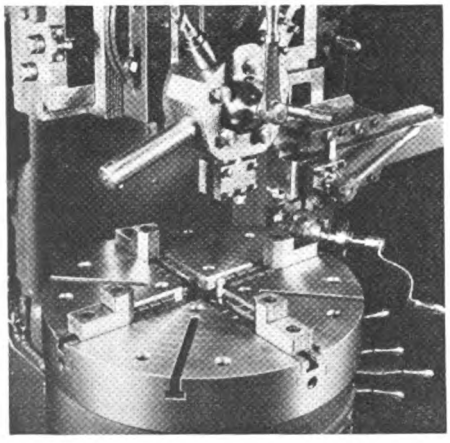
Controlled automatically and rated from 2 to 15 kw., the heaters are available in the suspension type for wall and ceiling mounting. The portable type, which while intended primarily for floor mounting, is readily adaptable for either wall or ceiling use. In some applications they effect economies by eliminating the installation and maintenance of steam piping to remote points, as well as the heat losses from such pipe lines.



A convection heater installed in the cab of an industrial electric locomotive

High-Speed Vertical Turret Mill

A high-speed vertical turret mill designed for boring, drilling and turning non-ferrous castings and forgings in high-speed production work has been developed by the Rogers Machine Works, Inc., 125 Arthur street, Buffalo, N. Y. Universal adaptability of these boring mills is increased by the use of a swivel side head that is adjustable at any angle each side of vertical up to 35 deg. to facilitate quicker tool setting on irregularly shaped pieces. A built-in graduated dial saves time in making setups for original and second runs.



Turret mill intended for use on non-ferrous castings and forgings—The main and side heads are shown

The horizontal chuck permits the work to slide easily and quickly into exact position in a minimum amount of time which reduces mill down time.

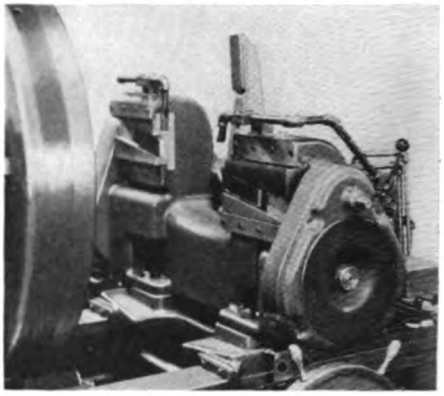
The main drive sheave of this high-speed model runs at 760 m. p. h. which is double the 380 r. p. m. of the standard Rogers vertical turret mill but both models have the same working capacities of 36 in.

Cut-Off Unit for Pipe Machines

The Landis Machine Company, Waynesboro, Pa., has recently developed a hydraulically controlled cutting-off unit. This device replaces the standard carriage, crossrail, and die head of the Landis mill-type pipe-threading machines where these machines are to be used only for the cutting-off operation and when maximum operating efficiency is desired.

The hydraulically-controlled cutting-off device uses two high-speed-steel cutting-off tools mounted in heavy slides. These tool slides function through a hydraulic cycle which provides rapid traverse of the tools to the work and rapid return of the tools after the cutting-off operation is completed. A single lever controls both the forward and return movements of the tool slide.

Complete operator control of the hydraulic cycle provides variable feed rates for the tools and adjustment of the length of travel of these tools for different thicknesses of tubing. The adjustment for rate of feed is made through a single control valve so that the rate of feed, for both the front and rear cutting-off tools will be the same. The tool slides are adjustable, within certain limits, for various diameters of tubing.



Hydraulically controlled cut-off head which replaces the standard carriage, crossrail and die head on Landis mill-type pipe-threading machines to be used exclusively in cutting off tubing

Silk Substitute Insulating Materials

Varnished rayon, varnished cotton cloth and varnished nylon have been developed by the Irvington Varnish & Insulator Company, Irvington, N. J., for electrical insulation formerly provided by varnished silk. All these materials possess good dielectric strength with tensile and tear strengths equal to or better than varnished silk and can be punched into special shapes. They are available in thicknesses from .003 in. to .008 in. in straight-cut rolls or bias cut strips in 51-in. lengths. Each base material is coated with Irvington special insulating varnish.



Dielectric strength of the three alternate materials is 1200 volts per thousandth inch thickness

Varnished rayon is the most suitable alternate for varnished silk, comparing favorably with it in strength and flexibility. It is used for wrapping leads, small magnetos and coils. Varnished cotton cloth has greater tensile strength than varnished silk. Its pliability permits application on odd shapes. Varnished nylon has qualities of flexibility and high tensile strength. At this time nylon is only available by government allocation.

(Turn to next left-hand page)

Frequently used REPAIR PARTS Should be ordered in proper quantity

FRANKLIN IS 100% on war work and asks the railroads' cooperation to enable us to supply repair parts promptly.

WHEN SMALL parts such as springs, gaskets, etc., that are used constantly are ordered by two's and three's, the process of supplying them is necessarily slowed down.

FREQUENTLY, orders call for only 6 gaskets, 2 perforated plates, 4 springs, and each item comes from a different purchaser.

A MULTIPLICITY of small orders wastes the Stores and Purchasing Dept.'s time as well as interrupts our manufacturing efforts.

PACKING and shipping of such orders also consumes material that will carry larger but still normal requirements.

FRANKLIN does not suggest stocking beyond normal inventories but would appreciate your cooperation by ordering such small parts in the maximum quantities permitted by WPB regulations.

FRANKLIN RAILWAY SUPPLY COMPANY, INC. NEW YORK CHICAGO

In Canada: **FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL**

High Spots in
Railway Affairs . . .

Two Million Soldiers Moved Every Month

According to Col. E. C. R. Lasher, deputy chief of the Traffic Control Division, Army Transport Corps, about two million soldiers are now being moved each month by the railroads in this country. This requires about 15 per cent of the day coaches and one-half of the sleeping cars. These requirements, coming at a time when civilian traffic is at a maximum, because of the nationwide gasoline rationing, naturally stress the railroad facilities to the limit. Moreover, as Colonel Lasher pointed out, "when a soldier moves, all his equipment has to go with him, so that he can dress himself, eat, drill, and if necessary, fight at a moment's notice."

Conventions in Wartime

Railroad passenger traffic has increased more than 50 per cent above last year's level. Troop movements are requiring more and more of the railroads' facilities. Director Eastman of the ODT emphasizes the fact that the railroads will have "extremely limited facilities in 1943 for passengers not in the armed services or not on business of an essential or emergency character." It is, of course, impossible for ODT to pass upon each of the many thousands of meetings and conventions that are normally held each year in the United States. It is suggested, therefore, that the officers and members of these individual organizations should ask themselves if the gathering will help shorten the war, and should abandon plans for meetings unless the question clearly merits an affirmative answer.

Air Line Competition

Many fantastic claims are being made about the extent to which the airplanes will take business away from the railroads after the war. While there is no question that the airplane will offer stiff competition to the railroads for passenger, mail and express package traffic, the handling of freight is quite a different matter. W. A. Patterson, president of the United Air Lines, in speaking before the National Industrial Conference Board, made a very thorough analysis of the costs of train and airplane operation. His conclusion was that, "When statements are made that our older forms of transportation—the railroads and steamship lines—are doomed, such statements cannot be supported by facts." Mr. Patterson pointed out that the future of the airplane in commerce is indeed great, but it appears that this future can be realized without serious inroads upon the steamship lines or the railroads. "The volume of domestic air cargo could increase one hundred-fold and yet capture only one-tenth of one per cent of the freight ton-miles now carried by the American railroads. But apart from that, the airplane should be expected to stimulate the generation of the type of traffic that is the rightful field for surface carriers."

Railroad Safety Awards

The late Arthur Williams, of the New York Edison Company, was deeply interested in accident prevention and for many years headed up the American Museum of Safety, which was organized even before the National Safety Council. It was through this organization that the Harriman Safety Awards, which have been so effective in stimulating safety activities on American railroads, were made. Mr. Williams made provision in his will for the establishment of the Arthur Williams Memorial Medal. The initial awards were recently made for distinctive achievement in safe transportation—one in the railroad industry, one in the marine field, and another for the airways. The rail transportation safety medals were awarded in duplicate to W. Averell Harriman and E. Roland Harriman "for continuing the inspiring leadership of two generations in safe transportation." E. H. Harriman, during his lifetime, went to unusual lengths to insure safe operation of the railroads under his direction. This is reflected in one way by the remarkable safety records that have been made over the years on the Union Pacific. It was after Mr. Harriman's death that his widow, the late Mary W. Harriman, established the Harriman safety awards. Her sons not only continued these medals, but have in many ways taken an active interest in the promotion of accident prevention movements. The presentation was made by Joseph B. Eastman, director of the Office of Defense Transportation.

"Make-Work" Practices

The demand of the five railway operating unions for a 30 per cent increase in wages is having some unexpected repercussions. A typical example is the editorial comment in the New York Times. Among the instances cited in its editorial on "Make-Work on Railroads," it included one case in which "a local freight crew dropped three cars and picked up three other cars on an oil company siding, doing work which required 15 minutes. There was no switch engine crew on duty at the time at this point. For this work the Board (National Railroad Adjustment Board) ordered not merely that the local freight crew should receive extra compensation, but that an extra yard foreman and an extra switchman, who were not on duty and performed no service whatever, should be awarded a day's pay for not having been used to do this work." The Times went on to say. "These are a few among many such decisions by the Board. They require the employment of additional men to perform work which these men are not needed to perform, and the employment and payment of men for whom there is no work available. It is clear that such decisions have compelled the railroads in many cases to adopt costly, wasteful and inefficient methods. In a total war, when skilled manpower falls far short of our needs, and when maximum production is a question of national survival, such make-work practices become inexcusable."

Traffic Solicitors And War Conditions

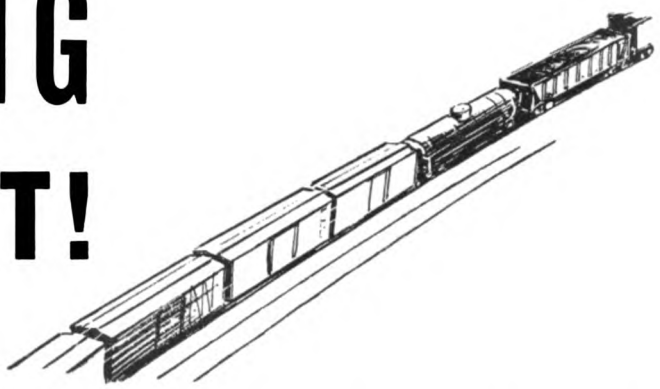
Interstate Commerce Commissioner J. Monroe Johnson, in correspondence with J. J. Pelley, president of the Association of American Railroads, criticized the practice of tracing shipments for individual shippers under war conditions. He even went so far as to suggest that railway traffic departments should be abolished for the duration. President Pelley pointed out, however, that the freight traffic solicitor is the contact man between the railroads and the shippers and can exert a most helpful influence in inducing co-operation to secure maximum efficiency from the available facilities. The traffic department personnel has also been reduced because of losing men to the armed services. There is plenty of constructive work to be done by those remaining in service, entirely aside from the actual solicitation of traffic.

Oil to East Coast

The fuel oil and gasoline situation on the East Coast is distressing. The amount of petroleum products being handled in tank cars by the railroads is well below 800,000 barrels a day; it was only 736,099 in the week ended December 12. The peak movement of 856,710 barrels daily was attained in the week ended September 19. Cold weather has had some effect in slowing up the movement and at the same time has increased the consumption in the eastern states. The ODT, working with the AAR, is using every means to increase this movement. Petroleum Administrator Ickes flew off the handle on December 10, and said that he had told President Pelley the railroads had to do "a damned sight better job than they have been doing lately." Obviously this was a very unfair statement; the railroads have been doing a magnificent job in moving oil and are entitled to commendation, rather than chastisement.

(*Turn to next left-hand page*)

FUEL SAVING
AN ARCH HABIT!

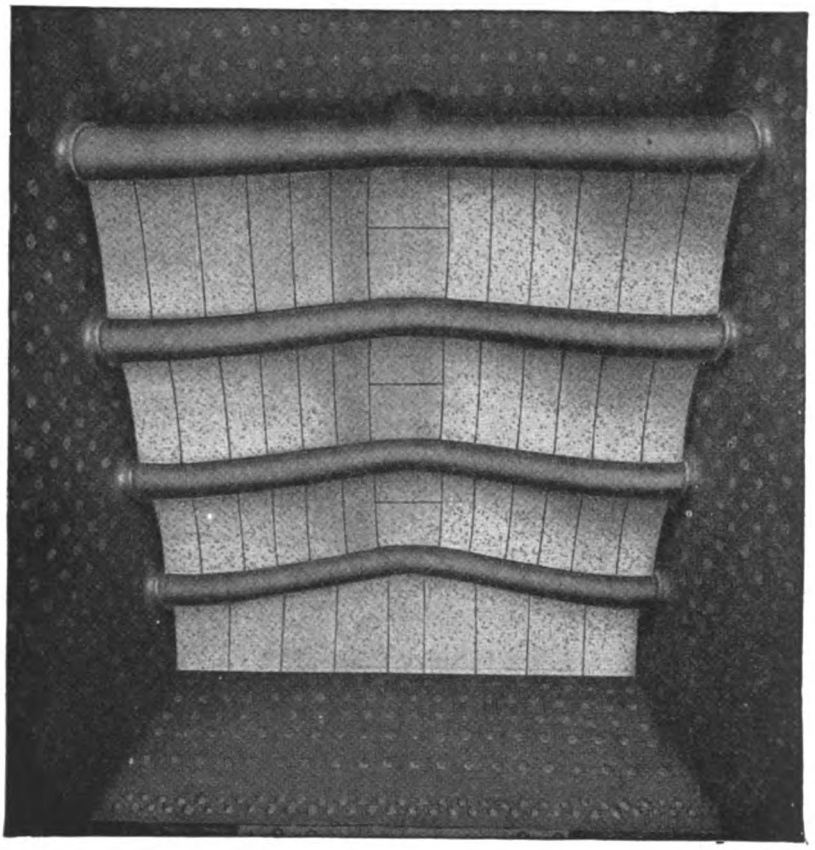


Over 32 years ago railroad men satisfied themselves as to the fuel saving of the locomotive Arch.

Since then the increase in locomotive power, higher rates of combustion and the widespread use of stokers has increased the fuel savings attributable to the Arch.

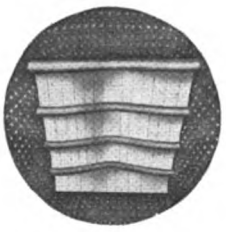
Today, when conservation of fuel is so vitally important to our war effort, don't handicap the effectiveness of the Arch by skimping on Arch brick. When your locomotives leave the roundhouse, be sure they are equipped with a *complete* Arch.





HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists



AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

NEWS

Alldredge Elected I.C.C. Chairman for 1943

REVERTING to the plan of rotating that office annually on the basis of seniority, the Interstate Commerce Commission has elected Commissioner J. Haden Alldredge as its chairman for the year 1943. He will succeed Commissioner Clyde B. Aitchison who served throughout 1942, first as acting chairman, and as chairman since the expiration on July 1 of the three-year term of Commissioner Joseph B. Eastman, who is on leave as director of the Office of Defense Transportation.

ODT Bulletin Lists Training Aids

THE Office of Defense Transportation's Division of Transport Personnel has prepared a bulletin describing the services of six government agencies which are prepared to assist the transportation industry in meeting the manpower shortage. Listed in the bulletin are facilities of the Civil Aeronautics Administration, the War Shipping Administration, and four agencies supervised by the War Manpower Commission. The latter are the Apprentice Training Service, the Training Within Industry Division, and two activities of the Office of Education, Engineering, Science and Management War Training and Vocational Training for War Production Workers. The bulletin is available from the ODT Division of Transport Personnel, Washington, D. C.

Equipment Purchasing and Modernization Programs

Central of Georgia.—The Central of Georgia is endeavoring to purchase eight steam freight locomotives of 4-8-4 wheel arrangement.

Missouri Pacific.—The Missouri Pacific has been authorized by the District Court to spend $4,613,380 for new equipment including 15 steam locomotives to cost $3,123,000.

Southern Pacific.—The Southern Pacific has applied to the Interstate Commerce Commission for authority to issue and sell $3,950,000 of equipment trust certificates, Series U, the proceeds to be used to finance in part the purchase of 22 oil-burning steam locomotives at a total cost of $5,350,394—18 of the 4-8-8-2 type, Class AC-11, from the Baldwin Locomotive Works, and four of the 4-8-4 type, Class GS-6, from the Lima Locomotive Works. The certificates will mature in equal installments of $395,000 each on January 1 of each year from 1944 to 1953, inclusive, the maturities to and including January 1, 1948, bearing interest at two per cent, and the remaining ones at 2½ per cent.

Union Pacific.—Division 4 of the Interstate Commerce Commission has authorized the Union Pacific to include in equipment covered by an issue of $13,250,000 of its series G equipment trust certificates 1,000 50-ton gondola cars and 3 locomotives in place of 1,251 box-cars which the War Production Board will not permit it to construct. The box cars were part of an order for 2,000 being built in U. P. shops. The substitute 50-ton composite gondolas will be built by the Pullman-Standard Car Manufacturing Company, and three high-speed freight locomotives of the 4-6-6-4 type by the American Locomotive Company. In addition to the 2,000 box cars, the original program called for 20 locomotives, 70 passenger-train cars, and 100 cabooses.

"Surplus" Equipment Inventory Order Modified by WPB

MOVING to facilitate redistribution, for the current equipment program, of inventories in the hands of car builders, the War Production Board on November 24 issued a supplemental order, amending Limitation Order L-97-A-1 to broaden the scope of its inventory controls. The amendment extends to the inventories of passenger-car builders restrictions which previously applied only to those of freight-car builders; and makes the "excess inventories" of both such builders available to locomotive builders.

The "excess inventories" involved are the steel and other materials accumulated by builders in 1941 and early 1942 for the then-projected programs which were curtailed by WPB. Heretofore, such inventories of the freight-car builders could be sold only to other freight-car builders. Commenting on the broadening amendment, the WPB announcement said that "the emphasis at present is on the side of locomotive construction," adding that the supplementary order "is expected to accomplish a continuous balancing of inventories by permitting similar sales and exchanges in all departments of the business, including passenger and freight car shops, locomotive works, and parts manufacture."

Previously the announcement had pointed out that no passenger-car production was authorized in the recently determined 1943 program. Thus the desire to redistribute inventories of materials in the hands of passenger-car builders.

Rules for Replacing Motors

IN AN effort to put every usable motor in the country to work producing war materials, the WPB is appealing to manufacturers who have idle motors to make them available for sale and to all manufacturers to use their motors to best advantage and for as long as possible. The recently issued General Conservation Order L-221 is designed to encourage maximum use of existing motors and to conserve materials in future production.

Under the order, all purchasers desiring new motors must certify to the motor

(*Continued on next left-hand page*)

Orders and Inquiries for New Equipment Placed Since the Closing of the October, 1942, Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Ann Arbor	2[1]	660-hp. Diesel-elec.	American Loco. Co.
Atchison, Topeka & Santa Fe	20[1]	4-8-4	Baldwin Loco. Wks.
Chicago, Milwaukee, St. Paul & Pacific	2	1,000-hp. Diesel-elec.	American Loco. Co.
Kansas City Southern	4	1,000-hp. Diesel-elec.	American Loco. Co.
Lehigh Valley	5[1]	1,000-hp. Diesel-elec.	American Loco. Co.
Nashville, Chattanooga & St. Louis	10[1]	4-8-4	American Loco. Co.
	5[1]	1,000-hp. Diesel-elec.	
Nevada Consolidated Copper Corp.	1[2]	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
New York, Susquehanna & Western	2[1]	1,000-hp. Diesel-elec.	American Loco. Co.
Northeast Oklahoma	1[3]	500-hp. Diesel-elec.	General Electric Co.
Richmond, Fredericksburg & Potomac	2[2]	1,000-hp. Diesel-elec.	American Loco. Co.
Wabash	2[1]	1,000-hp. Diesel-elec.	American Loco. Co.
Western Pacific	8[1]	1,000-hp. Diesel-elec.	American Loco. Co.

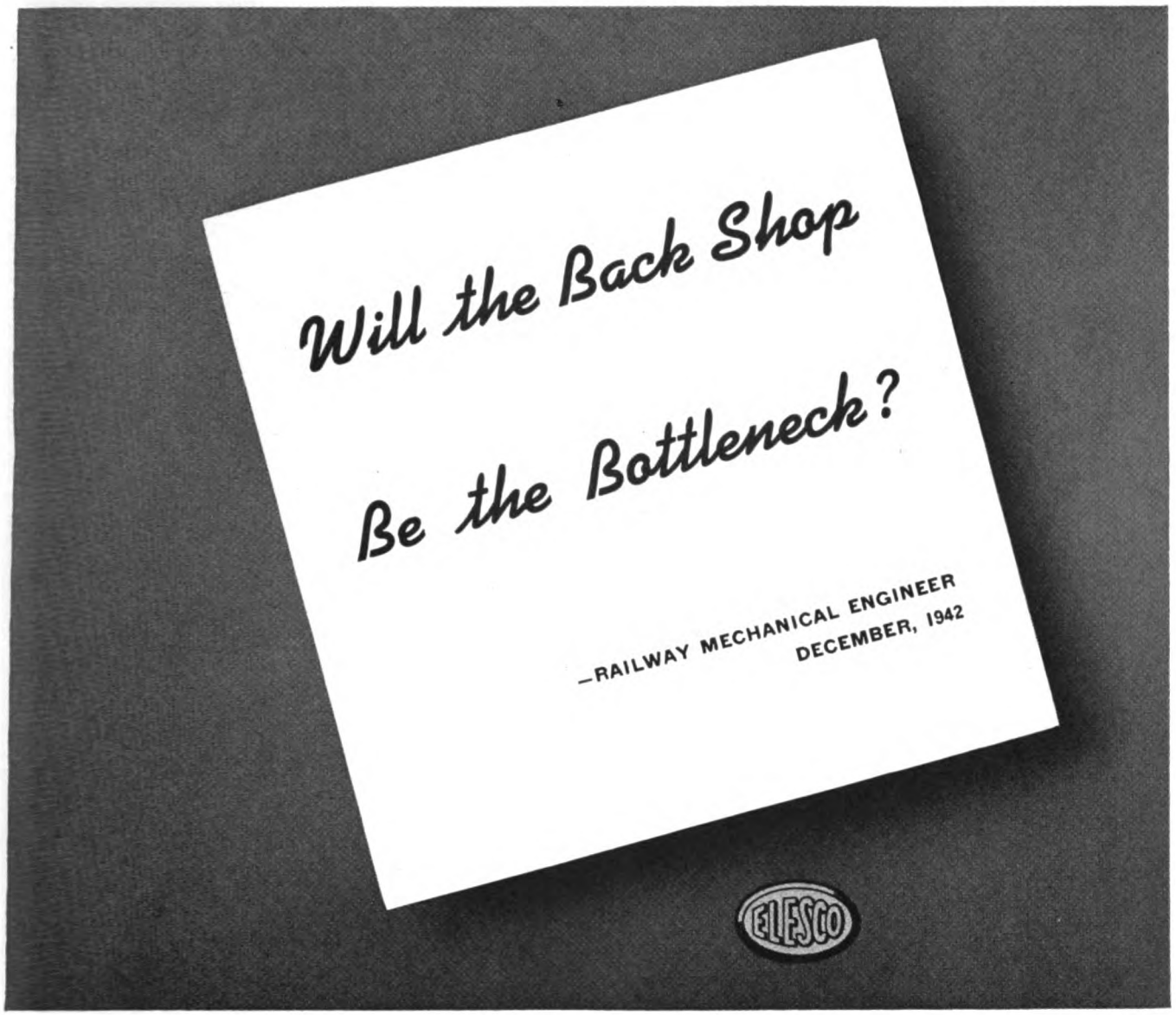
FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Ann Arbor	50[1]	50-ton hopper	Mather Stock Car Co.
Akron, Canton & Youngstown	50[2]	40-ton box	Wabash R. R. shop
Missouri-Kansas-Texas	17[1]	Caboose	Company shops
Monongahela Connecting	65[4]	120-ton gondola	
	20[2]	100-ton hopper	Company shops
Norfolk & Western	100[1]	70-ton gondola	Pressed Steel Car Co.
	25[1]	70-ton flat	Greenville Steel Car Co.
Union Pacific	1,000[2]	50-ton gondola	Pull.-Std. Car Mfg. Co.

FREIGHT-CAR INQUIRIES

Chicago, Rock Island & Pacific	400	70-ton gondola	
Delaware, Lackawanna & Western	100	70-ton hopper	
Denver & Rio Grande Western	200	70-ton flat	
Northern Pacific	250	50-ton gondola	
	300	50-ton flat	

[1] Subject to WPB approval.
[2] Authorized by WPB.
[3] Authorized by WPB. For delivery January, 1943.
[4] Authorized by WPB. For delivery May, 1943.



Old superheater units that are kept in service invariably need frequent attention at the backshops . . . which may cause bottlenecks in important repair work.

Have your old superheater units REmanufactured at the Elesco plant where they were originally manufactured—it will relieve labor conditions at the backshop and will increase the availability and dependability of locomotives.

A-1554

SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

THE SUPERHEATER COMPANY

Representative of
AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
122 S. Michigan Blvd., CHICAGO
• • •
Montreal, Canada
THE SUPERHEATER COMPANY, LTD.

manufacturer from whom they are ordering that they have no idle motor in their possession which can be adapted; that they have attempted to obtain a used motor from at least three dealers; that the motor is not being purchased for replacement purposes; and that it is required for immediate use.

The purchase of replacement motors requires specific approval by the War Production Board, granted only when repairing is impossible and used equipment unobtainable.

The order also contains a number of conservation and simplification provisions. It requires purchasers of motors to show that the horsepower of the motor for which they are applying is no greater than that required to do the job. It prohibits the delivery or acceptance of motors, unless they comply with standard manufacturing specifications and are of the simplest practicable mechanical and electrical design, with the smallest use of critical materials. The order also greatly restricts the use of special type motors, requiring additional manpower and materials to manufacture.

New York "El" Cars Now Carry War Workers in Illinois

FIFTY-FIVE former New York elevated cars are being reconditioned and placed in service on the Illinois Terminal to carry war workers from Springfield, Ill., to the Sangamon and Oak Ordnance plants near Illiopolis. The cars, formerly operated on the Sixth Avenue elevated line, were purchased by the government, which is paying the Illinois Terminal a flat sum for the service of an electric locomotive and a train crew. The cars were conditioned in the shops of the American Car and Foundry Company in St. Charles, Mo., while electrical work and final tuning up was done in Terminal Company's shops in Decatur.

The first cars, painted tangerine, were placed in service as the Victory Special on November 30, and were hauled by an electric locomotive that had been painted red, white and blue. Each car has three rows of seats, one one each side of the car and extending the full length of it and parallel with the sides, and a third, wide enough for but one passenger, in the middle. The capacity of each car is 80 persons. The fare charged by the government is $1.50 each week per person for the 25 miles.

Mechanical Division, A. A. R.

CARS DELAYED AWAITING REPAIR MATERIALS.—A recent A. A. R. Mechanical division circular letter points out that excessive delays are being experienced in making repairs to freight and passenger cars on foreign roads, where it becomes necessary to order repair materials from the owners and requests are transmitted by mail. This is true particularly where shops of the car owner of the repairing line are separated by a considerable distance.

Due to the urgent demand for passenger, tank and open-top cars, the circular instructs that when it becomes necessary to request material for repairs to such foreign cars from the car owner, such orders should be transmitted by telegraph, telephone, or air mail, and the material forwarded the same day if possible. Furthermore, any material weighing less than 250 lb. gross weight must be shipped by express, as specified in Rule 122.

The same method of handling requests for material should be followed between the repair point where a car is held and the office of the repairing line which transmits such requests to the car owner. The letter emphasizes the importance of this matter under present conditions and urges that it be brought to the attention of supervisors and all others concerned, in order to avoid all possible delay in returning cars to service.

ODT Union-Management Group Proposes Railroad Labor Transfer

A RECENT session of the railroad union-management conference, meeting with Office of Defense Transportation representatives in Washington, considered problems arising out of the railroad man-power shortage—threatened or already developed in certain localities—and selected a subcommittee to plan detailed procedure for the temporary shifting of railroad employees from places where the labor supply is adequate to spots troubled by shortages.

The subcommittee will make complete plans for arranging for employee leaves of absence for such purposes, for the maintenance of seniority rights by transferred men, for notice to be given men recalled to their original jobs, and for other measures intended to make the available labor supply go as far as possible.

Employees likely to be affected include engineers, firemen, trainmen, shop mechanics and skilled track workers.

Rock Island Shopmen Start Stay-on-Job Campaign

IN line with a nation-wide movement to avoid delays in vital war transportation, employees of the Chicago, Rock Island & Pacific shops are launching a program to "Stay on the Job." Every effort is being made to eliminate absenteeism which interrupts work schedules and holds up vitally needed equipment.

The unprecedented strain on locomotives and all types of equipment because of the demands of war transportation requires the services of every shopman for a maximum work week, it is pointed out. Periodic laying off by employees, even of one man for a single day, frequently cripples the output of a shop. Yet it is this type of irregularity, this laying off for brief periods, that is the most difficult to control, according to shop foremen and supervisors.

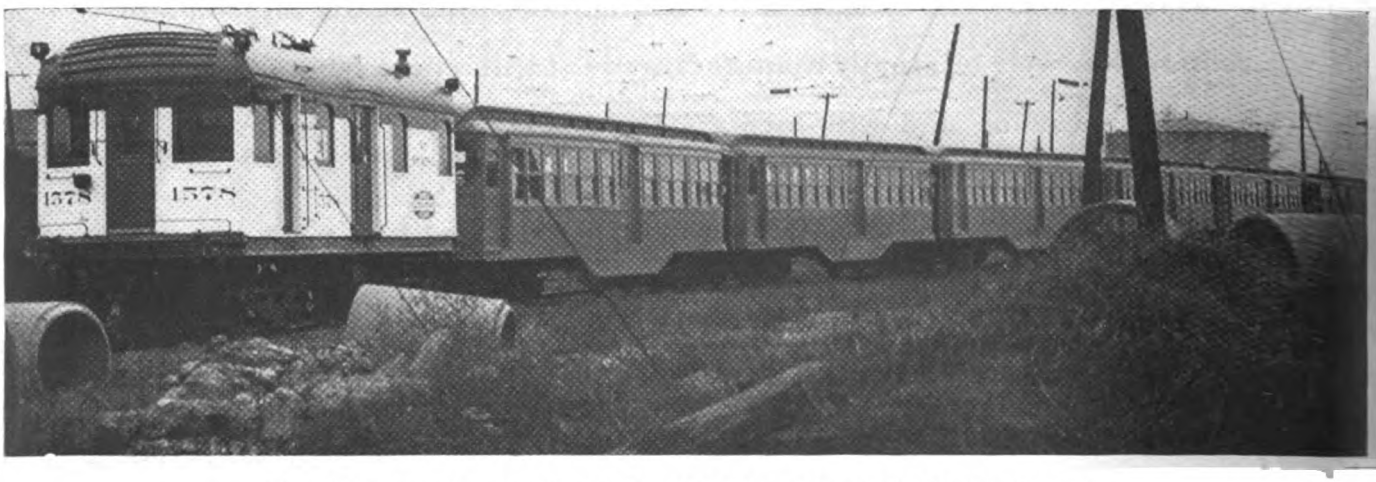
The "Stay on the Job" campaign is being augmented by a series of posters designed to emphasize the importance of regularity among workers on the home front. The first of the series pictures a railway shop worker and a machine-gunner with the caption, "They're on the Job, Let Us Stay on the Job."

ODT to Become "Claimant" Under Materials Plan

THE Office of Defense Transportation is to be made a "claimant agency" under the War Production Board's new Controlled Materials Plan which is being launched on a gradual basis to become fully effective next July 1, it was learned this week. Thus will the transportation industry come out from under the wing of the WPB Office of Civilian Supply to assume a place for itself on the Requirements Committee which doles out available materials.

Although no official announcement of the change had been made, it is understood

(*Continued on third right-hand page*)



Eleven "El" cars and a red, white and blue locomotive make up the "Victory Special"

To The Railroads For Efficiency In Handling A Record Volume Of War-Time Passenger Traffic—

An Everlasting Tribute

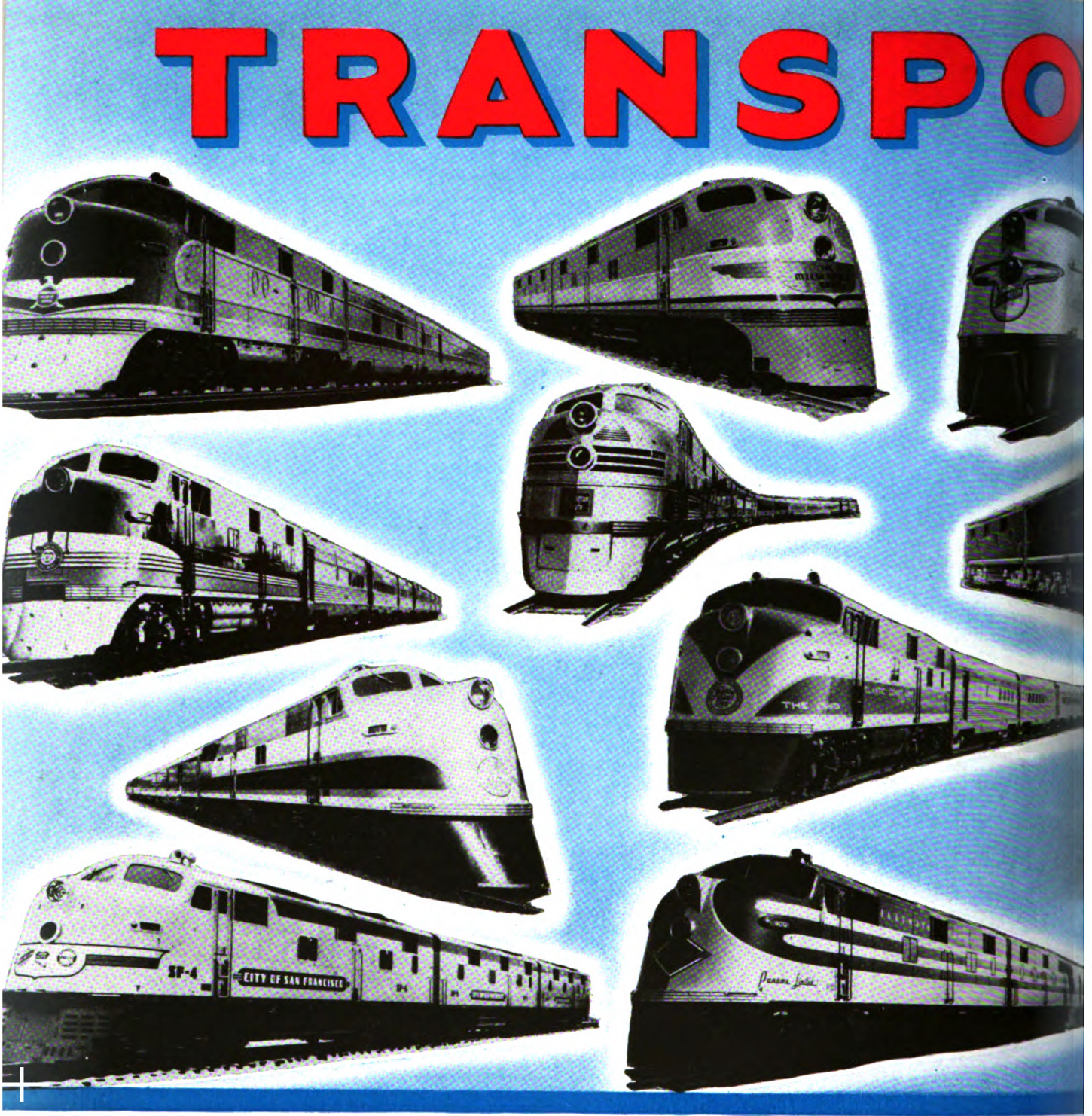
AMERICAN RAILROADS, faced with the greatest transportation responsibility in our nation's history, are doing a remarkable job in moving our armed forces, materials and supplies with maximum safety and dispatch. In the first six months of this year they have carried 5,250,000 fighting men in organized movements—more than were carried in the first fifteen months of World War I... And these record achievements have been accomplished with fewer passenger cars and fewer locomotives... This means that all available locomotives and cars, as well as all supporting equipment and facilities, are being used to the very limit of their capabilities, because *transportation* is vital to VICTORY and—

VICTORY IS OUR BUSINESS



GENERAL MOTORS LOCOMOTIVES

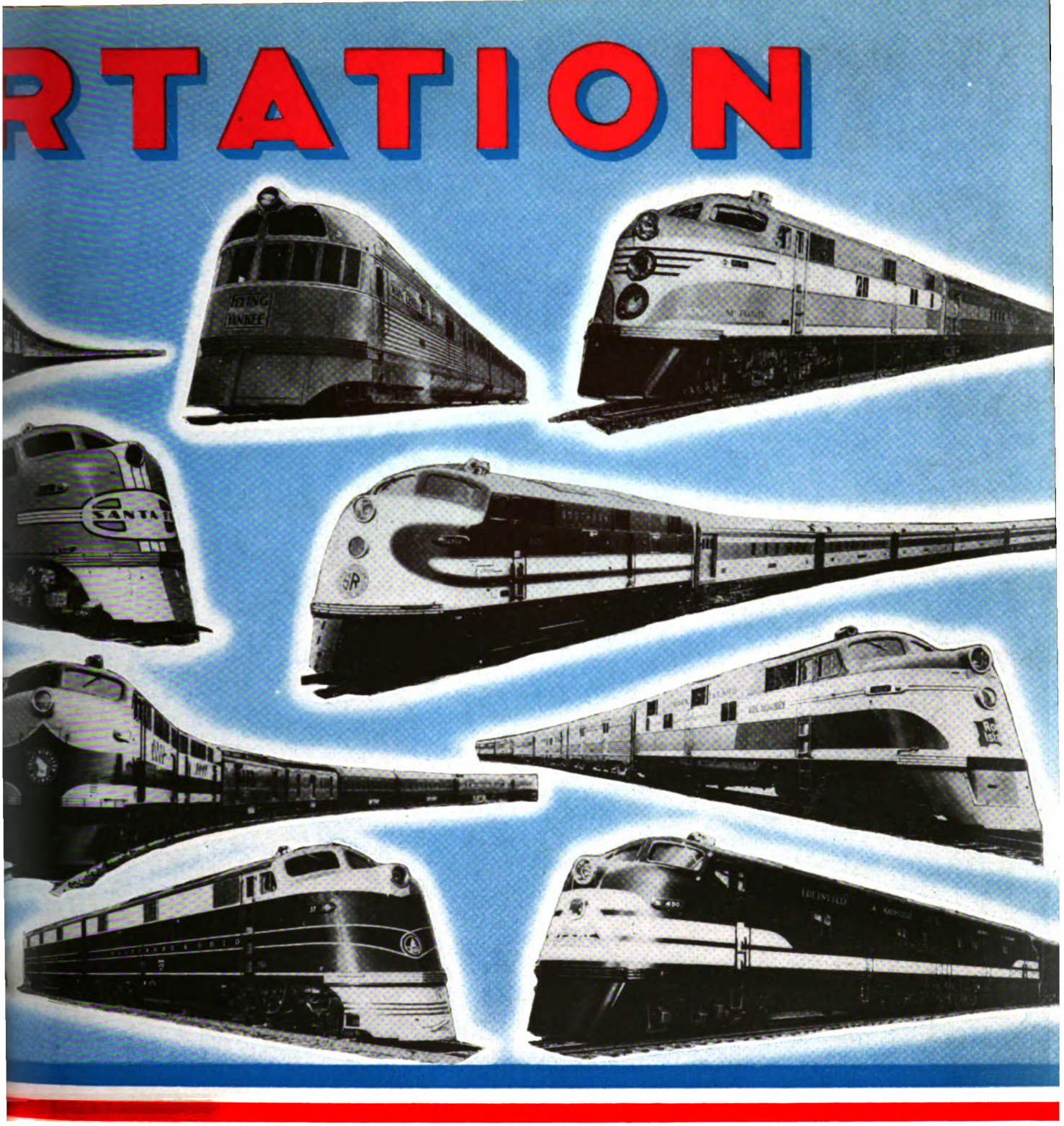
ELECTRO-MOTIVE DIVISION



IN WAR

THE railroads of America, faced with the greatest transportation problem in history, are doing a phenomenal job. Transportation enters every stage of production from the time raw materials leave the ground until the finished products reach their final destination. Without transportation, guns, tanks and planes would be useless, because they can't fight in our factories . . . We have reached the point where the volume of both passenger and freight traffic exceeds all previous records, with the result that the railroads have been called upon to use every available unit of motive power to the very maximum of its capabilities . . . Time is everything. Every minute — every hour — every day counts. Fighting men cannot wait. Delay in getting equipment and supplies to our fighting forces may mean the difference between victory and defeat. General Motors Diesel Road Locomotives on 27 railroads are doing their part in meeting this challenge. Transportation is vital to VICTORY and—

VICTORY IS OUR BUSINESS



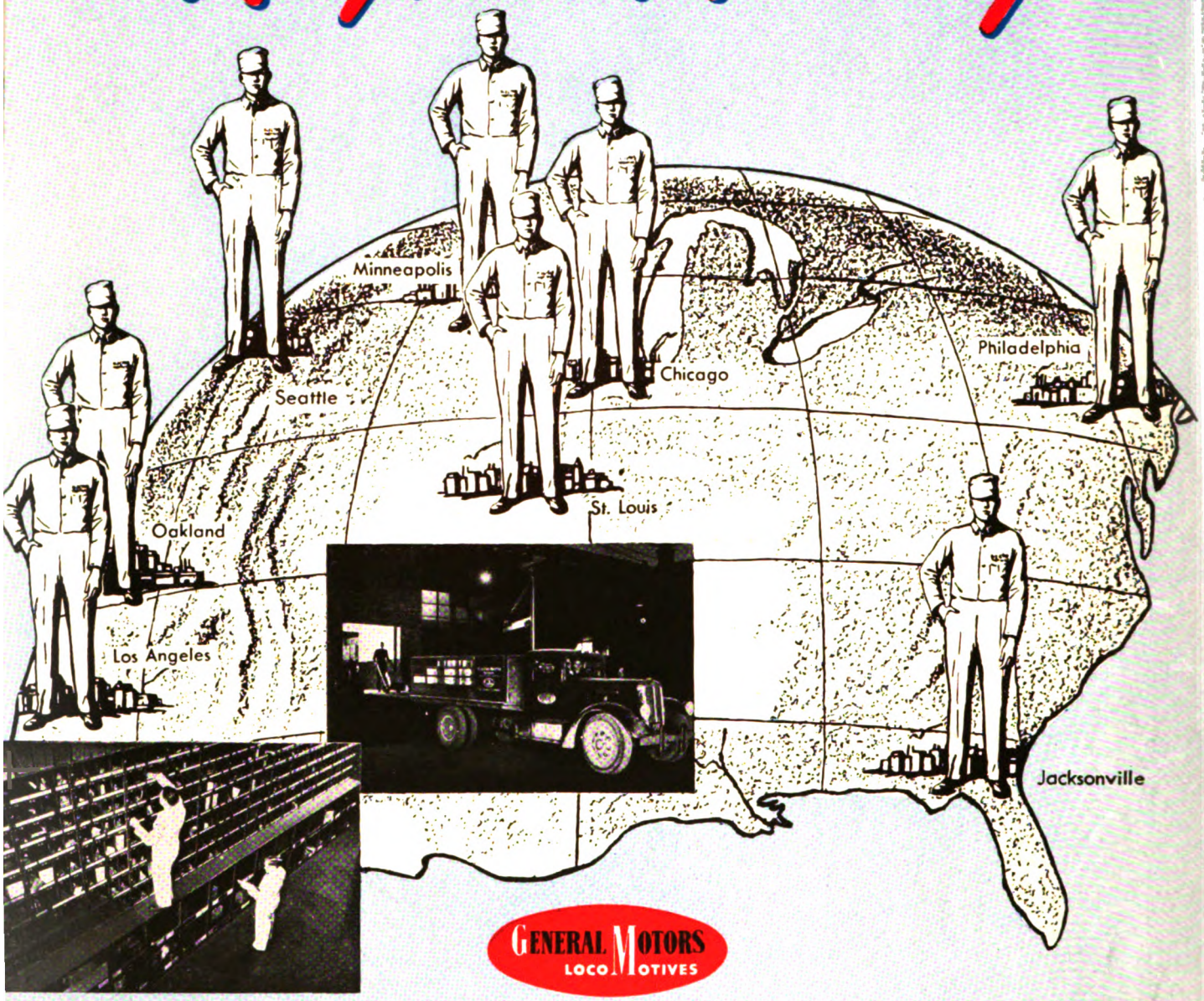
IN PEACE

WHAT transportation problems peace will bring to the railroads, no one knows. But one thing is certain — the super-efficiency demonstrated during the war assures their ability to meet the new forms of competition and other conditions which they are bound to face after the war. Because of America's proven superiority in the building of planes and ships, it is reasonable to expect a public demand for more extensive improvements in rail equipment and service. The railroads are not going to relinquish their present leadership in passenger and freight transportation. They will carefully analyze the entire picture and plan accordingly. General Motors Diesel Road Locomotives will continue to make possible greater hauling capacity — faster schedules with maximum comfort and safety — high availability — less wear and tear on rail and bridge structures — lower operating costs — increased revenues.

WHO SERVES THE RAILROADS—SERVES AMERICA

GM SERVICE "WARDENS"

Keep 'em Rolling



GENERAL MOTORS LOCOMOTIVES

CONFIDENCE in a product and in those who make it results only from long, satisfactory dealings and proved superiority of performance and service. Fundamental, of course, is the element of quality . . . In the present emergency, with passenger and freight traffic at an all-time high, all available locomotives have been pressed into service and are being used to the limit of their capabilities . . . General Motors Diesel Road Locomotives are playing a vital part in the nation's transportation network and everything possible is being done to keep these super-performers rolling with the highest degree of availability . . . GM Service "Wardens" and eight strategically located parts depots STAND GUARD day and night to protect this equipment. Every order for parts leaves the closest depot within the working day and normally no replacement part is more than 24 hours away from any piece of GM equipment now in service. This long established service policy insures receiving the right part — at the right place — at the right time — and strengthens our pledge to "Keep 'Em Rolling" for VICTORY because

VICTORY IS OUR BUSINESS

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION — LA GRANGE, ILLINOIS, U.S.A.

that ODT is one of several additional agencies to be given "claimant agency" status, the others including the Petroleum Administration for War, and the Office of Rubber Director Jeffers. As noted in the December issue, page 546, where the Controlled Materials Plan was outlined, the original "claimant agencies" were the Army, Navy, Maritime Commission, the Aircraft Scheduling Unit, Lend-Lease, Board of Economic Warfare, and the Office of Civilian Supply.

Civilian Supply's representative on the Requirements Committee has been Joseph L. Weiner through whom ODT presentations requesting material allocations for the transportation industry have heretofore been made. Mr. Weiner has been promoted from the position of deputy director to director of the Office of Civilian Supply, succeeding Leon Henderson.

Supply Trade Notes

THE INDEPENDENT PNEUMATIC TOOL COMPANY has removed its Boston, Mass., office to 78 Brookline avenue.

◆

THE PRIME MANUFACTURING COMPANY, Milwaukee, Wis., has acquired the products of the Graham-White Sander Corporation, Roanoke, Va.

◆

D. G. MITCHELL has been appointed vice-president in charge of sales of Sylvania Electric Products, Inc. This is a new office, established to plan and direct the distribution and merchandising of all Sylvania products.

◆

UNITED STATES STEEL SUPPLY COMPANY.—The name of the Scully Steel Products Company, Chicago, subsidiary of the United States Steel Corporation, has been changed to United States Steel Supply Company.

◆

HUNT-SPILLER MANUFACTURING CORPORATION.—*Preston W. Lampton* has been appointed representative of the Hunt-Spiller Manufacturing Corporation of Boston, Mass. Following his graduation from the University of Kansas in 1939, Mr. Lampton completed a two-year special machinist



Preston W. Lampton

apprenticeship with the St. Louis-San Francisco at Springfield, Mo. He had been employed as a draftsman in the office of the mechanical engineer of that railroad since January, 1941.

Gordon L. Leach has been appointed assistant to the president of the Hunt-Spiller Manufacturing Corporation. Mr. Leach was born in Boston, Mass., in 1905 and is a graduate of Philips Exeter Academy and Harvard University. He was formerly employed in the mechanical department of the Boston elevated railway, and joined the Hunt-Spiller Manufacturing Corporation as sales representative in 1930. During the past year he has been handling



Gordon L. Leach

affairs in connection with the Priority department, which duties he will continue.

◆

AMERICAN STEEL & WIRE CO.—*Cecil W. Guyatt,* formerly assistant chief industrial engineer, has been named chief industrial engineer of the American Steel & Wire Co. *John S. Conant* has been made priorities administrator, at the same time continuing as general supervisor of production planning, and *Lloyd W. Hackley,* formerly supervisor of production planning in the cold rolled department at the Cuyahoga works in Cleveland, Ohio, has been appointed assistant general supervisor of production planning for the entire company.

Army-Navy Production Awards

Recognition of high achievement in the production of war equipment has been made by the presentation of the Army-Navy "E" to the following companies:

Carnegie-Illinois Steel Corporation. Two stars affixed. Previous awards to this United States Steel Corporation subsidiary included the Bureau of Ordnance flag and the Navy "E" pennant, announced October 24, 1941, and, later, the All-Navy "E" burgee.

Union Asbestos & Rubber Company, Paterson, N. J., plant.

DAMON DEB. WACK, assistant to the president of the National Bearing Metals Corporation, has been elected executive vice-president of that company in active charge of all plants. Until his appointment as assistant to the president of the National Bearing Metals Corporation about a year ago, Mr. Wack was vice-president of the Pacific coast division of the parent corporation, the American Brake Shoe & Foundry Co.

◆

NATIONAL MALLEABLE & STEEL CASTINGS COMPANY.—*Wilson H. Moriarty,* assistant to the first vice-president of the National Malleable & Steel Castings Co., has been promoted to the position of assistant to the president, and *Walton L. Woody,* plant manager at Sharon, Pa., has been promoted to the position of assistant to the president in charge of the Sharon, Pa., and Melrose Park, Ill., steel castings plants.

Obituary

FRANK A. KRONER, transportation specialist of the General Electric Company's transportation department, Atlanta, Ga., died November 28 in that city.

◆

ELMER H. FATHAUER, sales agent of the National Malleable & Steel Castings Co., in St. Louis, Mo., died in Decatur, Ill., on November 19. He was 47 years of age.

◆

HARTE COOKE, senior engineer of the Diesel engine division of the American Locomotive Company at Auburn, N. Y., died December 14. He was 71 years old.

◆

DAVID S. YOUNGHOLM, vice-president of the Westinghouse Electric & Manufacturing Co. in charge of the lamp division at Bloomfield, N. J., has died.

◆

ROBERT H. WEATHERLY, president of the Pilliod Company since 1910, died December 1. He was 68 years of age. During his career Mr. Weatherly had been an assistant superintendent of the Scarritt Car Seat Works; assistant to the vice-president of the American Steel Foundries, and vice-president of the Scullin Steel Company.

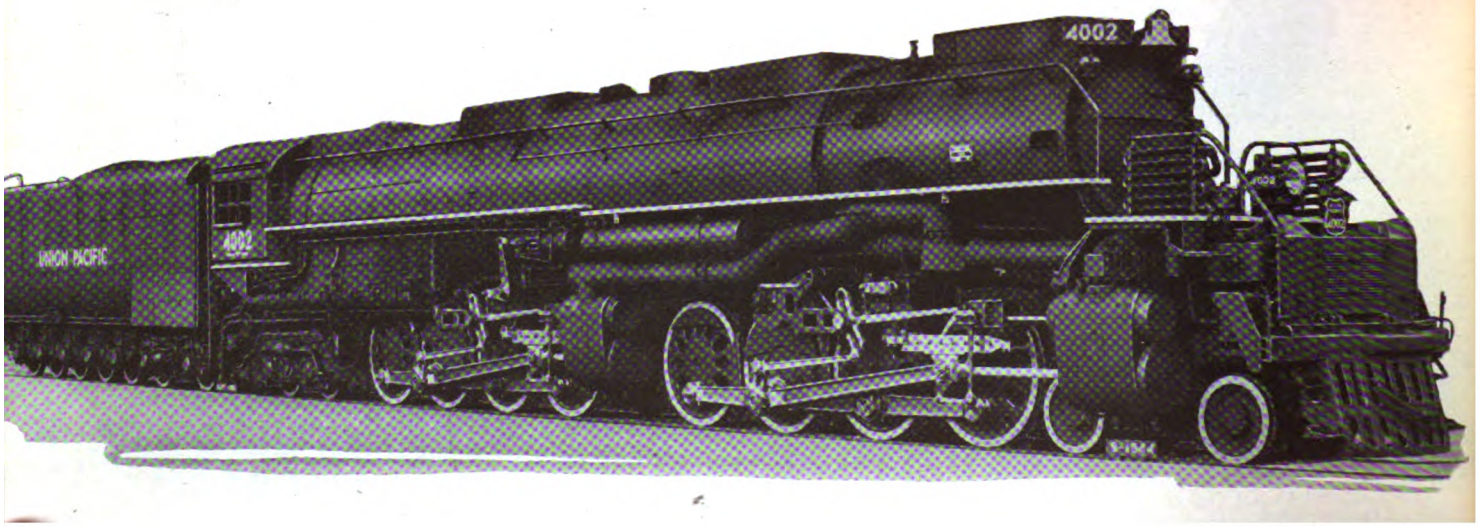
◆

WILLIAM H. FENLEY, western manager of the Kerite Insulated Wire & Cable Company at Chicago, died on November 22.

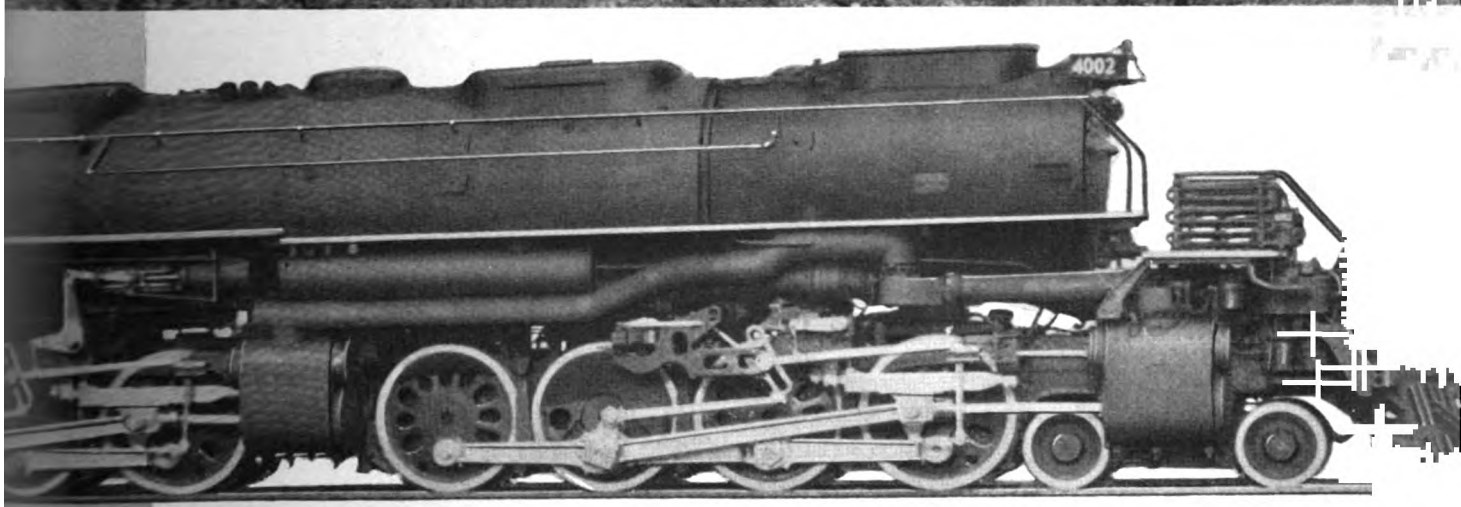
(*Continued on second left-hand page*)

BIG BOY









"Big Boy"—the world's largest and most powerful steam locomotive.

Not just one, but twenty of these gigantic locomotives are giving remarkable and outstanding performance in the movement of war traffic in the mountainous western territory of the Union Pacific—"The Strategic Middle Route" to and from all the West.

Locomotive Characteristics

Weight on Drivers	540,000 lb.
Weight of Engine	762,000 lb.
Cylinders (Four)	23¾ x 32 ins.
Diameter of Drivers	68 ins.
Boiler Pressure	300 lb.
Tender Capacity—Fuel	28 tons
Tender Capacity—Water	24,000 gals.
Tractive Power	135,375 lb.

AMERICAN LOCOMOTIVE

Manufacturers of Mobile Power

Steam, Diesel and Electric Locomotives, Marine Diesels, Tanks, Gun Carriages and other Ordnance



Mr. Fenley was born at Greenwood, Ind., May 7, 1876, and entered railway service in September, 1895, as a brakeman of the Cleveland, Cincinnati, Chicago & St. Louis. In the following year he was promoted to yard master and in 1898 was employed by the National Switch & Signal Co. In the



William H. Fenley

same year he returned to the Big Four, where for two years he was towerman and signal maintainer. He resigned in 1900 to enter the employ of the Chicago Great Western and during the next 11 years held the positions of signal foreman, electrician, signal inspector, signal supervisor, office engineer and signal engineer. In 1911, he was a sales engineer of the Union Switch & Signal Co. and in September of that year became signal engineer of the Panama Railroad, where he put "standard code" train operation in effect and later became superintendent of telephone, telegraph and signals. He also built the trans-Isthmian duct line and underground conduit in the Panama fortifications. In June, 1915, he entered the employ of the Kerite Insulated Wire & Cable Co. and in 1922 was promoted to western manager. He was president of the National Railway Appliances Association in 1930-31 and president of the Railway Electric Supply Manufacturers Association in 1925-29.

◆

WALTER P. MURPHY, chairman of the Standard Railway Equipment Manufacturing Company, Chicago, and head of numerous other railway equipment manufacturing companies, died suddenly at the Ambassador hotel, Los Angeles, Calif., on December 16, following a heart attack. Walter Patton Murphy was born at Pittsburgh, Pa., on January 26, 1873. In the 1880's his father sent the family to western Kansas to live on 160 acres of land, which he had acquired, while he continued to work elsewhere in railroad shops. After several years the family returned to East St. Louis, Ill., where Mr. Murphy's father was trying to manufacture a box-car roof that he had invented. Mr. Murphy, who was then 16, entered railway service in a machine shop; and later became successively a fireman and locomotive engineer. While working, he also found time to study part-time at St. Louis University and after finishing as much college work as he could find time for, was appointed a foreman of the Missouri Pacific shops at Coffeyville, Kan., later being promoted to the position of foreman of the St. Louis shops and then going with the Union Pacific. In 1898 he left railroad service to join his father in the equipment manufacturing business. At that time one of the great difficulties that confronted the railroads was the tendency of freight to knock out the ends of box cars under the stresses created by sudden stops and starts. To overcome this, Mr. Murphy developed the corrugated steel end for box cars. He also developed a method of rebuilding old freight cars to increase their capacity and enable them to accommodate automobiles and improved the design of refrigerator cars, increasing their floor space and making it possible to maintain an even low temperature throughout, which greatly facilitated the transportation of perishables. In addition, Mr. Murphy continued his father's work on the design of car roofs, on which feature alone he held more than 40 patents. Mr. Murphy was chairman of the Standard Railway Equip-



W. P. Murphy

ment Company; president of the Metal Products Company; and president of the Standard Railway Devices Company.

In 1939 he contributed nearly $7,000,000 for the construction and equipping of the new Technological Institute of Northwestern University at Evanston, Ill., an engineering school which features co-operative courses. The Institute as it was formally dedicated on June 15 and 16, 1942, is described on page 324 of the July, 1942, *Railway Mechanical Engineer*

Personal Mention

General

WILLIAM Q. DAUGHERTY, whose promotion to assistant superintendent of motive power and car equipment of the Gulf, Mobile & Ohio, with headquarters at Jackson, Tenn., as reported in the December issue. Mr. Daugherty was born at Verona, Miss., and entered railway service in 1892 in the Decatur (Ala.) shops of the Louisville & Nashville, later serving three years in road service as a locomotive fireman. In August, 1898, Mr. Daugherty went with the Mobile & Ohio (now part of the Gulf, Mobile & Ohio) as a locomotive fireman and two months later was promoted to the position of enginehouse foreman at E. St. Louis, Ill. In March, 1901, he was appointed traveling fireman and a year later returned to E. St. Louis as enginehouse foreman. In May, 1903, he became general foreman at Meridian, Miss., and in February, 1911, he was appointed master mechanic at Jackson, Tenn. He became assistant superintendent of motive power and car equipment on November 1, 1942.



William Q. Daugherty

Master Mechanics and Road Foremen

J. A. DEMPSTER has been appointed master mechanic of the Gulf, Mobile & Ohio, with headquarters at Jackson, Tenn.

H. L. HEINZ has been appointed general road foreman of engines, Central Lines, of the Southern, at Knoxville, Tenn.

HARRY E. ANDERSON, assistant division master mechanic of the Atchison, Topeka & Santa Fe at La Junta, Colo., has been appointed to the newly created position of master mechanic of the Western division with headquarters at Dodge City, Kan., as announced in the December issue. Mr. Anderson was born on May 12, 1897, at Los Animas, Colo., and after completing high school in June, 1913, entered the mechanical department of the Atchison, Topeka & Santa Fe at La Junta as a boilermaker apprentice. He was a machinist ap-

prentice from October 13, 1913, to October 31, 1917, at La Junta and a machinist at the La Junta enginehouse until May 23, 1918, when he enlisted in the U. S. Navy. He returned to the Santa Fe on March 18, 1919, as a machinist at La Junta. On



H. E. Anderson

April 1, 1919, he became assistant day enginehouse foreman; on July 28, 1920, night enginehouse foreman; on January 15, 1923, day enginehouse foreman; on September 1, 1927, general enginehouse foreman; on April 14, 1938, general locomotive foreman in the back shop; on May 19, 1941, assistant master mechanic, and on November 1, 1942, master mechanic, Western division, Dodge City, Kan.

WILLIAM G. RINGLAND, assistant master mechanic of the New York Central, has been appointed master mechanic in charge of the motive power and car department,



W. G. Ringland

Pennsylvania division, with headquarters as before at Avis, Pa., as announced in the November issue. Mr. Ringland was born in September 28, 1888, at York, N. Y., and was graduated from high school at Oswego, N. Y., in 1905. He entered the employ of the New York Central on June 13, 1905, as a machinist apprentice and subsequently served as a machinist at the Oswego shops. On September 16, 1910, he became piecework inspector at the Oswego engine terminal and later terminal foreman at Ogdensburg, N. Y., and Watertown. Mr. Ringland was appointed to the position of assistant master mechanic, motive power department, Pennsylvania division, with headquarters at Avis, Pa., on October 16, 1939.

Car Department

R. H. DYER, general car inspector of the Norfolk & Western at Roanoke, Va., has retired. Mr. Dyer had been in the employ of the Norfolk & Western since 1895.

C. H. WRIGHT, general car inspector of the Boston & Albany at Boston, Mass., has been appointed division general car foreman, with headquarters at Beacon Park, Allston, Mass.

J. D. REZNER, general car foreman of the Chicago, Burlington & Quincy, has been promoted to the newly created position of superintendent of the car department, with headquarters at Chicago.

Shop and Enginehouse

CHARLES L. LEHNIS, a machinist in the employ of the Chesapeake & Ohio at Handley, W. Va., has been promoted to the position of enginehouse foreman at Handley.

Purchasing and Stores

CHARLES C. HUBBELL, general purchasing agent of the Delaware, Lackawanna & Western at New York, retired on January 1, 1943, after 47 years of service.

Obituary

J. F. NICKS, general car foreman of the Gulf, Mobile & Ohio at Whistler, Ala., died on December 3.

IRWIN ASHTON SEIDERS, retired superintendent of motive power and rolling equipment of the Reading Company, died on December 14, at his home at Reading, Pa. Mr. Seiders, who was born on October 23, 1864, was educated at the Tamaqua (Pa.) high school and entered railway service in January, 1882, as a laborer on the Reading. From 1883 to 1907, Mr. Seiders served successively as depot hand, brakeman, fireman, engineman, extra passenger engineman and as regular passenger engineman at Tamaqua. On the latter date, He was promoted to the position of road foreman of engines at Reading, and in 1914 became fuel inspector. In October, 1915, Mr. Seiders was appointed superintendent of motive power and rolling equipment, with headquarters at Reading, in which capacity he served until August, 1932.

HENRY HAGUE VAUGHAN, at one time head of the mechanical department of the Canadian Pacific, died on a visit to Philadelphia, December 11. Mr. Vaughan was born at Forest Hill, England, December 28, 1868. He came to this country in 1891 and entered the employ of the Great Northern in the mechanical department at St. Paul, Minn. Seven years later he became mechanical engineer of the Q and C Company and the Railroad Supply Company, Chicago. In 1902 he was appointed assistant superintendent motive power, Lake Shore & Michigan Southern. Two years later, in 1904, he became superintendent motive power of the Eastern Lines of the Canadian Pacific. He was promoted to the position of assistant to the vice-president in the following year. He went with the Dominion Bridge Company in 1916 as a vice-president and was engaged in the manufacture of munitions in Canada during the first World War. For many years Mr. Vaughan acted as a consulting engineer, with headquarters in Montreal, and was associated with the Canadian Foreign Investment Corporation, Ltd., and the Companhia Brasileira de Cimento Portland, a South American cement concern. He was a former president of the Engineering Institute of Canada and served a term as vice-president of the American Society of Mechanical Engineers, of which he was elected an Honorary Member in 1939.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

HARDSTEEL TOOLS.—Black Drill Co., 5005 Euclid avenue, Cleveland, Ohio. Illustrated booklet descriptive of Hardsteel in drills, reamers, tool bits and special tools.

◆

PREHEATING CHART.—Tempil Corporation, 132 West Twenty-second street, New York. Chart covers correct preheat temperatures and other pertinent data for 79 principal ferrous and non-ferrous alloys.

◆

STEAM HOSE.—The B. F. Goodrich Company, Akron, Ohio. Revised catalog page contains easy-to-read rules for the care and maintenance of steam hose, also data on inside and outside diameters, weight and number of plies.

◆

WHITING PRODUCTS.—Whiting Corporation, Harvey, Ill. "Whiting Products for Industry," Book No. 236, gives pertinent data on cranes, railroad and aviation equipment, cupolas and foundry equipment, etc.

◆

LOCOMOTIVE PACKINGS AND INSULATION.—Union Asbestos & Rubber Co., Chicago. Eight page, 6-in. by 9-in. catalog contains specific information and illustrations covering the use of Unarco products for packing locomotive air pumps, feed water heaters, cab cocks and power reverse gears and insulating high-pressure steam pipes.

◆

NE STEELS.—Joseph T. Ryerson & Son, Inc., Sixteenth and Rockwell streets, Chicago. "National Emergency Steels" tells what NE steels are; explains step by step the Jominy end quench hardenability test for determining heat-treatment response, and lists various NE steels as suggested alternates for standard compositions in the carburizing, medium hardening, and high hardening groups.

65% INCREASE IN BOILER TUBE LIFE

saves steel-speeds war effort!



CINDER-cutting was the chief cause of boiler tube troubles on an eastern railroad. Failures were occurring at about 85,000 miles of service. Then, NATIONAL Seamless Boiler Tubes were installed in 10 high-speed passenger locomotives. After 140,000 miles, the tubes were still giving good service without a sign of failure. This means many extra days on the rails and less time in the repair shops.

Why were NATIONAL Seamless Tubes so much more resistant to cinder-cutting? One reason is in the method of manufacture. Only the very best steel can be used in the seamless process. Any flaws in the metallic structure would show up immediately when the metal is pierced, for the piercing operation is one of the severest commercial tests of steel quality ever devised. Another reason — seamless tubes have no longitudinal weld—no long line of potential weakness to invite cinder-cutting or failure.

That's why engines that are equipped with NATIONAL Seamless Boiler Tubes are today showing the way with remarkable performance records, even under the increasingly heavy burdens our railroads now bear in the war program.

Furnishing boiler tubes to meet wartime demands is one of the many ways in which NATIONAL is assisting in the development of maximum efficiency in railroading equipment.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

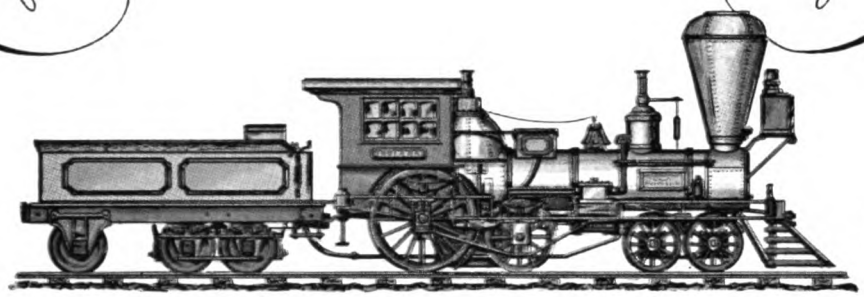
UNITED STATES STEEL

open here

The Latest Power for the Pennsylvania

by

BALDWIN



THE first

THE latest

Specifications

BALDWIN POWER FOR THE PENNSYLVANIA

In July, 1849, Baldwin completed the "Mifflin", a fast passenger locomotive, which was the first Baldwin engine to be placed in service on the new line extending from Harrisburg to Lewistown. Two similar locomotives, the "Blair" and "Indiana", were built for the Pennsylvania by Baldwin later in the same year, 1849.

These locomotives had a single pair of driving wheels back of the firebox, one pair of carrying wheels in front of the firebox, and a four-wheeled truck under the front end. An unusual feature was a "traction increaser" for the purpose of transferring weight from the carrying wheels to the drivers in starting, thus increasing the adhesion.

The new streamlined T1's, now in service on the Pennsylvania from Harrisburg to Chicago, are the latest locomotives of a very large number which Baldwin has built for the Pennsylvania since this great system was organized on February 25, 1847.

SPECIFICATIONS OF THE LATEST POWER FOR THE PENNSYLVANIA

BALDWIN LOCOMOTIVE FOR THE PENNSYLVANIA

Gauge	4' 8½"
Cylinders (4)	19¾" x 26"
Valves	Poppet type

BOILER

Type	Modified Belpaire
Diameter	F. 91½" B. 100"
Working pressure	300 lb.
Fuel	Bituminous coal

Firebox

Material	Steel
Staying	Radial
Length	138"
Width	96"
Comb. Cham. Length	96"

Tubes

Diameter	5½"	2¼"
Number	69	184
Length	18' 0"	18' 0"

Heating Surface

Firebox	269 sq. ft.
Combustion chamber	150 sq. ft.
Tubes 2¼"	1940 sq. ft.
Tubes 5½"	1779 sq. ft.
Circulators	71 sq. ft.
Total	4209 sq. ft.
Superheater	1680 sq. ft.
Grate area	92 sq. ft.
Firebox volume	641 cu. ft.

DRIVING WHEELS

Diameter, outside	80"
Diameter, center	72"
Journals, main—	
11½" diam. roller bearing	
Journals, others—	
11½" diam. roller bearing	

ENGINE TRUCK WHEELS

Diameter, front	36"
Journals—	
7" diam. roller bearing	
Diameter, back	42"
Journals—	
8" diam. roller bearing	

WHEEL BASE

Driving	25' 4"
Rigid	18' 5"
Total engine	51' 11"
Total engine & tender	107' 0"

WEIGHT, *in Working Order*

On driving wheels	268,200 lb.
On truck, front	100,200 lb.
On truck, back	128,800 lb.
Total engine	497,200 lb.
Total tender, fully loaded	433,000 lb.
(Average weight per pr. drivers	67,050 lb.

TENDER

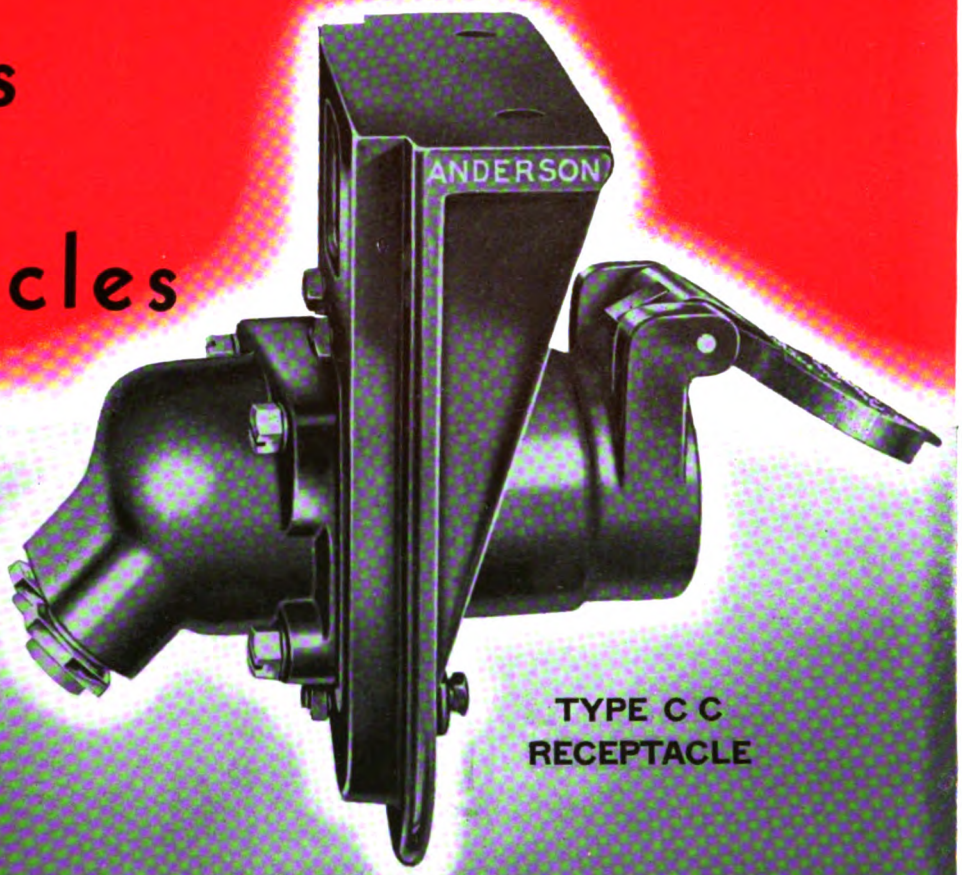
Wheels, number	Sixteen
Wheels, diameter	36"
Journals—	
6½" diam. roller bearing	
Tank capacity	19,500 U.S. gal.
Fuel capacity	41 tons
*Tractive force	65,000 lb.
Service	Passenger

Equipped with Type "A-S" superheater, feed water heater, stoker, five circulators, power reverse, one piece cast steel locomotive bed with integral cylinders, and air brake on all front truck, trailer truck, driving and tender wheels, with two 8½" cross-compound air pumps.

*Booster (estimated to develop 13,500 lb. tractive force), on engine 6111 only.

Anderson

Plugs and Receptacles



Anderson Plugs and Receptacles are designed for the following:

- Air Conditioning
- Battery Charging
- Marker Lights
- Yard Receptacles
- Platform Receptacles
- Portable Tools
- Telephones
- Switchboards
- Welding
- Cable Connectors
- Couplers
- Watertight Plugs and Receptacles
- Turntables
- Industrial Trucks

KEEPING abreast of the times has been one of the principles followed by us during the past 35 years of manufacturing battery charging equipment. Anderson Type CC Receptacles are the latest design for modern passenger cars, incorporating all the refinements and improvements necessary for reliable and economical service.

ALBERT and J.M. ANDERSON MFG. CO.

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NEW YORK **CHICAGO** **PHILADELPHIA** **LONDON**

I'm Tellin' You...

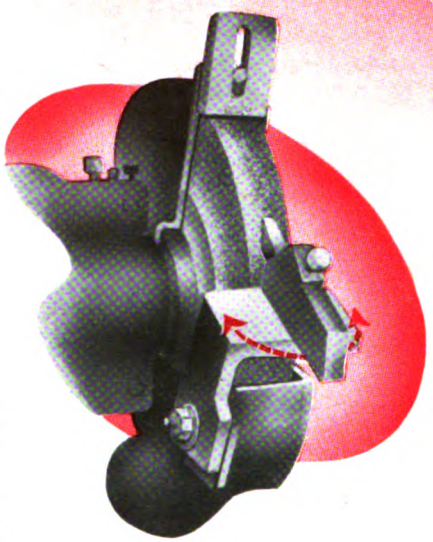
No. 5 in a Series of Tips on "Keeping 'em Turning"
by John Stephens, 41 years at LeBlond



One of the most common causes of trouble in lathe work is a dull or improperly ground tool. I'd like to illustrate a few of the correct steps for giving first aid to "beat up" tools. The best method is the semi-automatic grinding machine.

If your tool room has one, let the expert in charge do your grinding. But if you do your own grinding by the offhand method, watch these points.

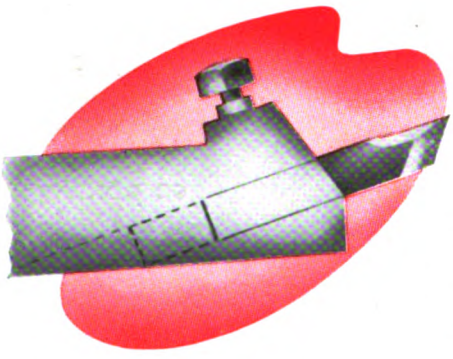


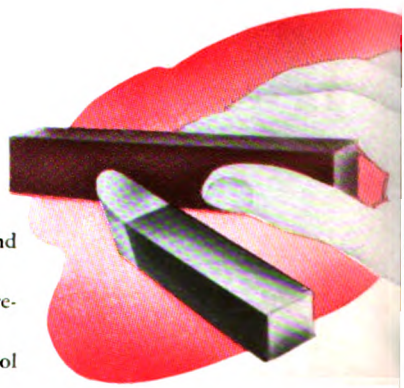


1. To cut free a tool must be ground with four correct angles—side clearance (top drawing) and back rake, side rake, and end clearance (shown on bottom drawing). These angles as well as the shape of the tool vary with the material to be chined. Refer to a tool manufacturer's manual.

3. The tool is supported on the work moved with a rocketing motion over the the entire grinding wheel. This prevents from turning and distributes wear on th

4. Tools used for finishing or for soft should be further sharpened with light st an India oil stone. Use of this stone is ommended between cuts. For roughing step is unnecessary.





2. The most satisfactory way to grind a tool bit is in its own holder. To prevent grinding the holder, extend the tool beyond its regular cutting position.

NAVY

THE R. K. LeBLOND MACHINE TOOL C

Cincinnati, Ohio

ortation
brary

Railway Mechanical Engineer

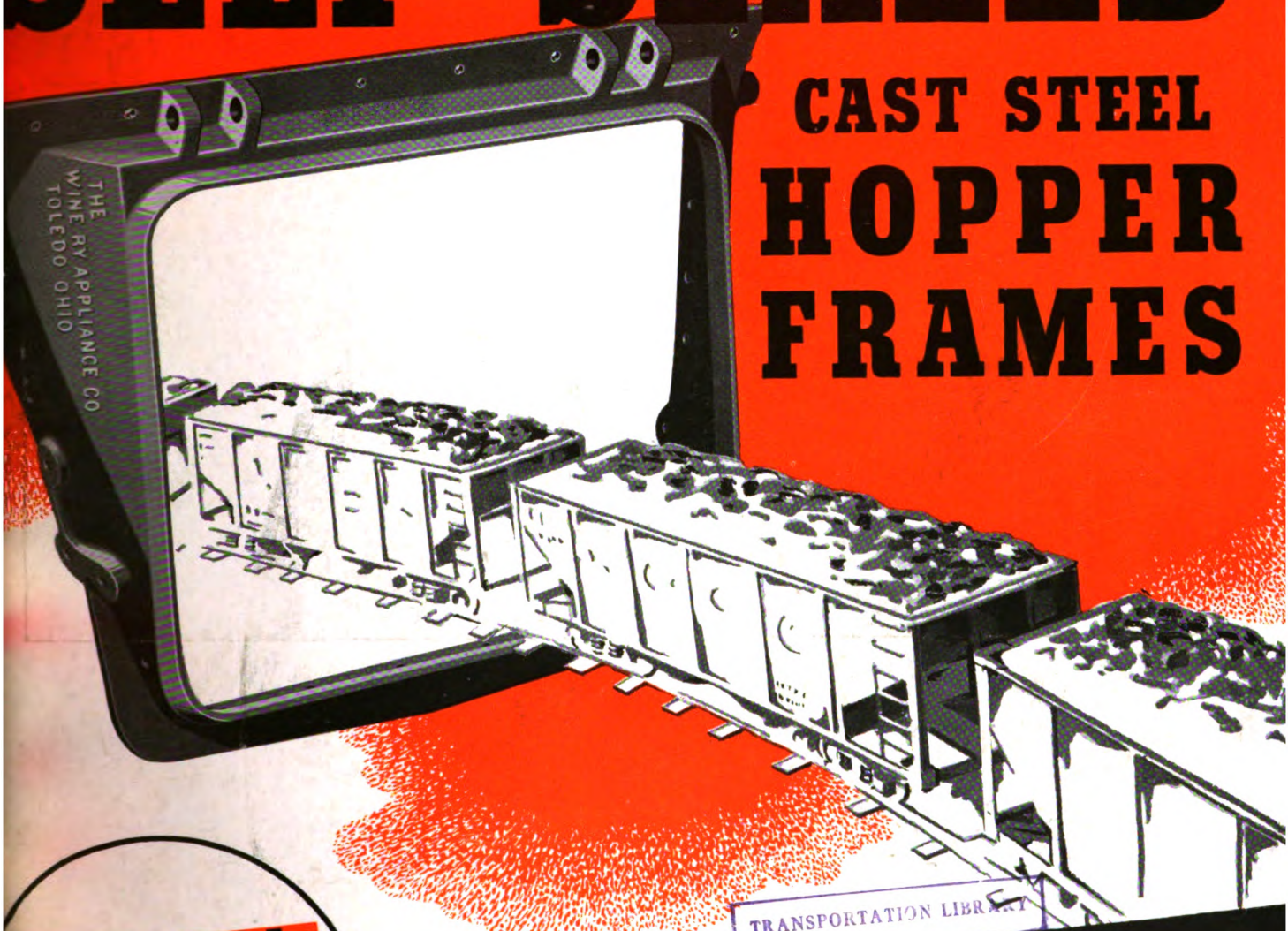
February
1943

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SELF-SEALED

CAST STEEL HOPPER FRAMES



WINE



THE WINE
RAILWAY APPLIANCE CO.
TOLEDO, OHIO.

CERTAIN TO REACH THEIR DESTINATION
WITHOUT LOSS OF LADING

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UNIT TRUCK

369,817 MILES OF MAINTENANCE FREE SERVICE

Over A Period of Five and One-Half Years

"and Still Going Strong"



UNIT TRUCKS will do the same under your cars.

- Fewer parts, less steel
- Correct design, lower maintenance.

Approved for interchange.

Full information as to licensees authorized to manufacture Unit Trucks will be furnished upon request.

UNIT TRUCK CORPORATION

140 CEDAR STREET NEW YORK, N. Y.

Published monthly by Simmons-Boardman Publishing Corporation, 1309 Noble Street, Philadelphia, Pa. Entered as second-class matter, April 3, 1933, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription price, $3.00 for one year, U. S. and Canada. Single copies 35 cents. Vol. 117, No. 2.

KING SANDER TRAP Nº 34



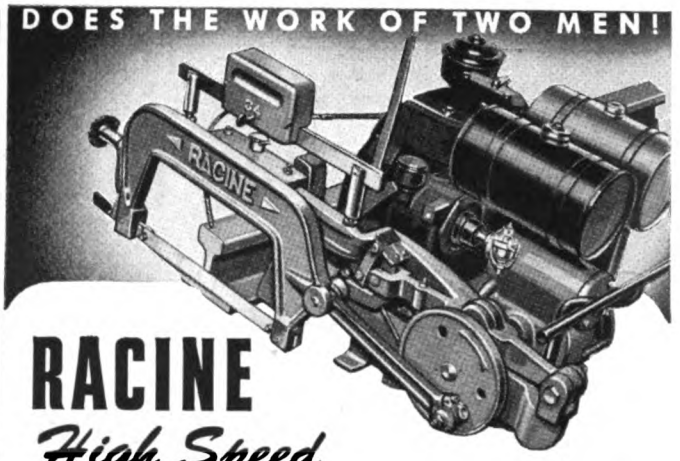
Provision for automatic cleaning blast embodied within the trap Adjustable for grade of sand, flow required and air pressure.

Single, Duplex and Triplex operating valves to suit varying arrangements.

THE U. S. METALLIC PACKING CO.
PHILADELPHIA, PENNSYLVANIA

Representatives in Canada
Jos. Robb & Co., Ltd., Montreal

DOES THE WORK OF TWO MEN!



RACINE
High Speed
PORTABLE RAIL CUTTER

FAST—SAFE—LOW COST

Rails can now be cut "right on the track"—no traffic delays. Fast, accurate rail cutting to three-tenths of an inch—eliminates heavy "on track" equipment—no extra handling of rails. Only two men required to transport Racine Cutter. Available with gasoline engine, electric motor or compressed air motor.

RACINE HYDRAULIC METAL CUTTING MACHINES

Also available for general purpose and production metal sawing. Hydraulically fed and controlled. Capacities 6" x 6" to 20" x 20".

RACINE *Variable Volume* OIL HYDRAULIC PUMPS

A Modern Source of Hydraulic Force—for clamping, feeding, molding, pressing and numerous other operations.

Request complete information and prices. Address Dept. RM-S.

RACINE TOOL AND MACHINE CO.
Standard for Quality and Precision
RACINE, WISCONSIN, U.S.A.



Simplifies Repairs

ALL the bearings in the new Baker Valve Gear are pivotal, with connections made by pins and bushings. Renewal of these restores the gear to its original condition.

Compare this simple maintenance to building up and grinding of links, renewal of blocks, etc. All parts on Baker Gears are standard and therefore interchangeable.

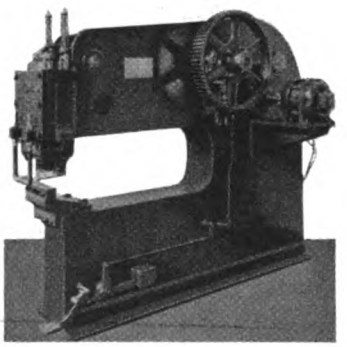
THE PILLIOD COMPANY
Factory—Swanton, Ohio
30 Church St., New York, N. Y. 310 S. Michigan Ave., Chicago, Ill

THOMAS EQUIPMENT
..for Railroad Shops



BENDING AND SHAPING MACHINES • SPACING TABLES

SHEARS • DUPLICATORS • ANGLE BENDERS



Thomas Steel Frame Vertical Punches

Built in a wide range of capacities and throat depths. Favored for use in car-shops and shipyards and wherever steel is fabricated. Equipped with interchangeable tools for punching and shearing.

THOMAS
MACHINE MANUFACTURING COMPANY
PITTSBURGH, PA.

PUNCHING EQUIPMENT

THE EDITOR'S DESK

MATERIAL AND EQUIPMENT SITUATION

The railroads have had and are having a difficult time in securing materials and equipment vital to their successful operation. Fortunately they have had the wholehearted support and co-operation of ODT and the railway supply manufacturers. They have had to struggle along, however, as best they could with limited supplies, and that at a time when the manpower problem has been growing steadily worse.

In the last analysis, in spite of all these handicaps, they have made good to a remarkable extent in handling the traffic offered to them, and without congestion. It has not been an easy or a simple task. It has required careful planning and a lot of ingenuity.

While there is no question but what they are suffering from deferred maintenance of one sort or another, mileage has been built back into the cars and locomotives and they are giving an excellent account of themselves, even though much of the equipment is not of the most modern design and cannot be operated as efficiently as that which is new and up-to-date. It must be admitted that, generally speaking, the government agencies, in the light of other pressing demands, have been reasonably successful in protecting the railroads with those materials and supplies necessary to keep the machine going.

What the year may bring forth is not at all clear. Apparently the production of war equipment and materials has thus far progressed even beyond the expectations of the Administration. It takes time to rearrange our whole economy and set up the machinery to get ample materials to fighting fronts all over the world. Results seem to indicate that these needs are not only being met, but, what is much more important, reasonable reserves are gradually being built up at places where they may be most needed. This is, of course, as it should be, and well back of the lines as we are, we can well afford to scrape along on a minimum of materials and supplies, always assuming that we must guarantee ample transportation, which is fundamental to the continued success of our production processes and in getting supplies to the fighting fronts. In the light of these facts, it may well be that more consideration can be given to the needs of the railroads as the year goes on.

One thing is certain. The railroads have surpassed all expectations in doing their part of the job, and those who predicted—and in some cases it is to be feared, hoped for—a breakdown of the railroads and government operation have been disappointed. Let's do our level best with the limited equipment, supplies and manpower, to keep them disappointed. We will thus make a large contribution to the continuance and preservation of the American way of life.

Roy V. Wright

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SHOP TIME *can be measured* IN TRAIN LOADS...

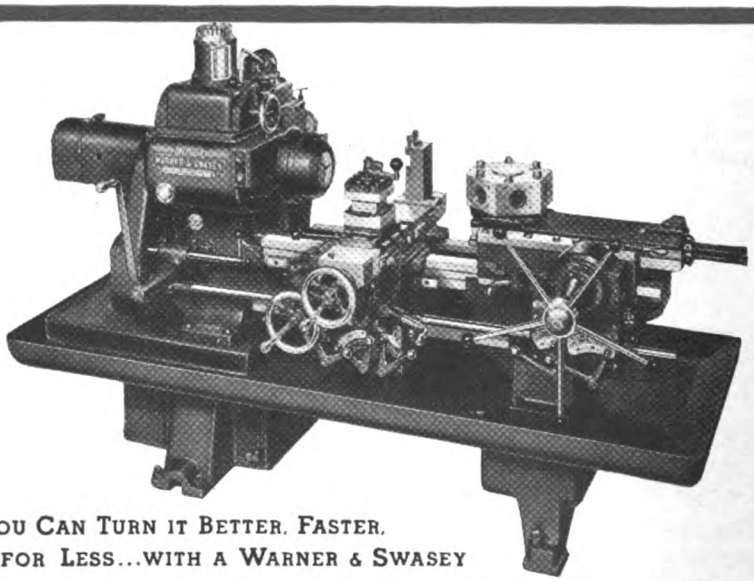
MINUTES saved in the shops today are indeed precious—they mean thousands of dollars in pay miles. America's 44,300 locomotives with its 45,200 passenger cars and 2,000,000 freight cars are transporting 25,000,000 net tons every 24 hours over 23,000 freight trains daily. What a load this gigantic operation throws on the railroad repair shops.

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Gas-Turbine Locomotive*

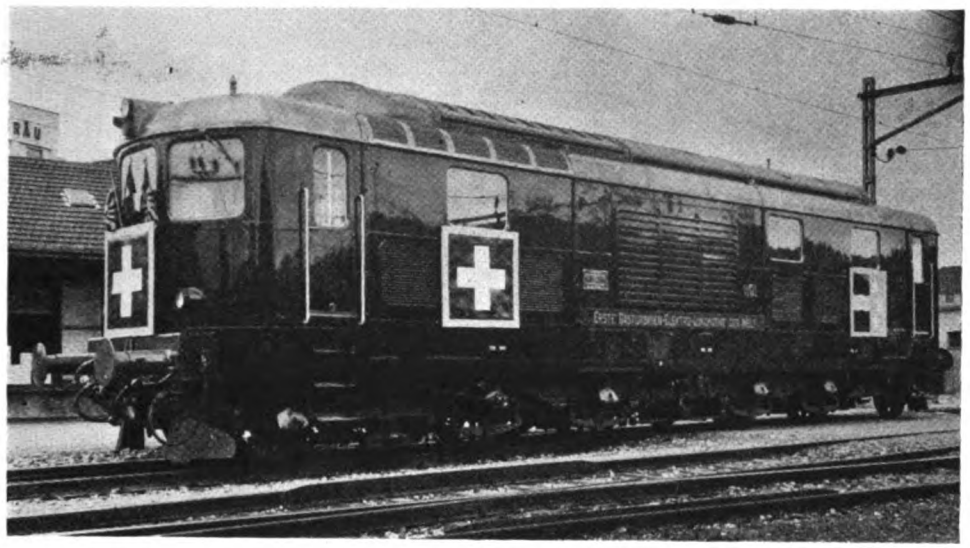


Fig. 1—Swiss Federal Railways gas-turbine locomotive

By Paul R. Sidler†

In 1939 Brown, Boveri & Company, Ltd., undertook to build the first gas-turbine locomotive for the Swiss Federal Railways. While the outbreak of the war delayed its completion the locomotive was completed in the fall of 1941.

Again, due to the war conditions in all countries surrounding Switzerland, there is a severe shortage of any liquid fuel, so that it was not possible to arrange for as large a number of test runs over a wide variety of lines as would otherwise have been desirable. However, several road tests of sufficient duration and over various tracks were made to demonstrate that not only the guarantee conditions had been met but the expectations were exceeded in many instances.

The completed locomotive is shown in Fig. 1 as it started out on the first trip under its own power in September, 1941.

The complete power unit is assembled on a heavy auxiliary frame and can be lifted into the locomotive as a whole, as shown in Fig. 2.

Before going into these test results, it might be well to recall briefly the basic layout of a gas-turbine power plant, the principal elements of which are shown in Fig. 3.

The compressed and preheated air is introduced into the combustion chamber partly as combustion air through the nozzle ring *1* and partly as cooling air through slots *2*. The fuel enters through the injection nozzle *3*. Combustion gas and cooling air mix in chamber *4* and form the driving gas proper, which expands through the gas turbine. The exhaust gases which still have a high temperature, pass the air preheater from *5* to *6* where they leave through the locomotive roof. The air inlet to the compressor is at *7*. The outlet air duct *8* from the compressor to the heat exchanger is provided with several expansion joints *9* to allow for different expansion in the gas turbine set and the preheater.

Table 1—Characteristics of the Swiss Combustion Turbine Locomotive

Continuous output of power unit at generator coupling (at a turbine speed of 5,200 r.p.m. and a generator speed of 812 r.p.m.), hp.:	2,200
Tractive force rating at the wheel tread:	
At starting (from 0-16 m.p.h.), lb.	29,000
1 hour (at 30 m.p.h.), lb.	17,000
Continuous (at 45 m.p.h.), lb.	11,000
Maximum speed, m.p.h.	70
Maximum service weight including fuel, lb.	202,000
Maximum axle load, lb.	35,200

Built into the same frame with the main generator *F* is an auxiliary generator for electric train heating, rated at 200 kw.

It seems desirable to point out that electric transmis-

* Abstract of a paper presented at the A. S. M. E. annual meeting in a joint session of the Oil-Gas Power and Railroad Divisions, Dec. 2, 1942.

† Resident engineer, Brown, Boveri & Co., Ltd., New York.

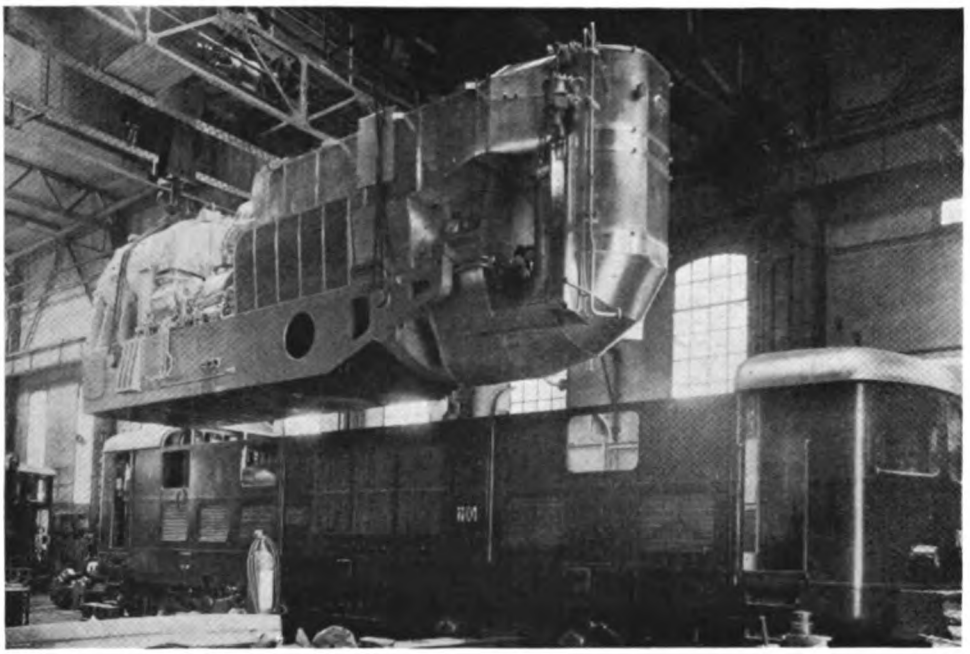


Fig. 2—Gas-turbine unit being lowered into the locomotive in the shop

sion was selected because its operation is well known and tried out while hydraulic or mechanical transmissions for such outputs do not appear to have outgrown an experimental stage and would, therefore, introduce considerable uncertainties. The fact that this locomotive with electrical transmission has been in operation for more than one year, while projects with hydraulic transmission, developed elsewhere, have not progressed beyond the paper stage, certainly confirms the correctness of this choice.

The governing system of the gas-turbine locomotive was adapted with a few changes from the well-tried pressure oil-operated field regulating system that has been in satisfactory operation on many Diesel-electric locomotives.

Table II—Comparative Data for Three Test Runs

	Run No. 1	Run No. 2	Run No. 3
Length of the line, miles	100.2	60.4	41.55
Total weight of train, short tons	430	313	313
Change of elevation, ft.	+906	+1358	-266
Average ruling grade, per cent	0.171	0.4265	-0.121
Running time including stops, min.	147.5	101.5	52
Number of stops	9	7	1
Running time without stops, min.	130.5	83.5	50
Average speed without stops, m.p.h.	46	43.5	49.7
Output at generator terminals, kw.-hr.	1,597.6	818.5	428.3
Input at generator coupling, kw.-hr.	1,735.5	892.5	466
Fuel consumption (Bunker C), lb.	2,805	1,783	998
Fuel consumption, lb. per hr.	1.2063	1.4923	1.5973

The diagram, Fig. 4, shows the operating stands at both ends with the main controllers. By moving this controller from step to step the engineman regulates the supply of fuel to the burner and the speed of the gas-turbine set and, through the speed governor, also controls the generator field regulator which in turn influences the electrical output. The proper co-ordination of all these devices is assured by oil relays operated from a common pressure oil supply which, during starting, also lubricates all bearings.

The operating characteristics of the gas turbine power unit have been plotted in Fig. 5 from measurements taken during acceptance tests. The principal characteristics of the locomotive as prescribed in the order are shown in Table I.

The weight requirements were imposed by the contemplated service of the locomotive on branch lines where traffic density has not justified electrification. For main-line service the axle load could be about 15 per cent higher.

Results of Service Tests

Table II shows the results of actual test runs over three territories differing in physical characteristics. Table III gives the results of acceleration tests with a 321-ton train (including the locomotive). Data derived as a result of these test runs has already shown the possibility of improvements that could be made on future locomotives of this type, particularly with reference to fuel consumption at partial loads.

Comparisons With Steam and Diesel Power

In a paper before the A. S. M. E. last year E. E. Chapman, Atchison, Topeka & Santa Fe, gave an interesting comparison of steam and Diesel-electric locomotives.* Although the gas turbine locomotive has not yet accumulated sufficient operating experience to establish all characteristics accurately it is of interest to tabulate some of Mr. Chapman's findings and add the corresponding data for the gas turbine locomotive. This has been done in Table IV. Some figures for the latter are, it is admitted, based on careful estimates rather than operating experience over extended periods of time.

Table III—Acceleration Tests With 321-Ton Train

Grade, per cent	Speed m.p.h.	Time measured, sec.	Time guaranteed, sec.	Acceleration, m.p.h. per sec.
0	56.00	112	150	0.5000
1.2	37.30	97	150	0.3850
1.8	24.85	90	100	0.2760
2.6	18.65	100	100	0.1865

Some further comments in connection with several of the above characteristics seem appropriate:

The cost of the gas-turbine locomotive is based on quantity production similar to Diesel or steam locomotives.

* An abstract of Mr. Chapman's paper appeared in the Railway Age for July 26, 1941, page 149.

As the gas-turbine locomotive has no reciprocating parts, the time out for repairs should be the smallest of the three. One may, of course, question the durability of the turbine blading. For the conservative gas temperatures chosen, experience with a large number of exhaust-gas turbines and continuous combustion turbines shows practically no wear of this blading even after several years of operation.

The gas-turbine locomotive requires no water, but does need a considerably larger fuel tank than the Diesel locomotives, thus taking a longer time for refuelling.

As the gas-turbine locomotive has no reciprocating parts and works below critical speeds throughout the range, it should allow of even higher schedule speeds than the Diesel locomotive.

Neither the Diesel nor the gas-turbine locomotive have unbalanced weights; the gas-turbine locomotive has a lower weight per horsepower, thus less track wear.

The equality of fuel costs for Diesel and gas-turbine locomotive is valid only for oil-producing countries or other regions where the cost of fuel oil is about half that of Diesel oil.

The lubricating-oil costs for the gas-turbine power plant are negligible; the axles and the running gear require, of course, the same amount of lubrication as in other types.

The small water requirements for the auxiliary Diesel engine for starting the gas turbine has not been considered, as this set will only run a few minutes each day; the use of air-cooled auxiliary Diesel engines is contemplated in future locomotives.

While it is clear from this comparison that the gas-turbine locomotive is not as yet a serious competitor for the Diesel locomotive, it is also evident that in certain classes of service it will show marked advantages. It should be particularly suitable for express service over long distances in areas where water is scarce and where there is a considerable difference in the cost of Diesel oil as against ordinary fuel oil.

Table IV—Comparative Characteristics of Three Types of Motive Power

	Steam	Diesel	Gas turbine
Approximate cost per hp.	$35	$87	$65
Efficiency at draw-bar, per cent	6-8	26-28	15-16
Mileage per year	180,000	250,000	over 250,000
Time for tanking and refuelling	greatest	least	small
High scheduled speed	lowest	higher	higher
Track wear	large	less	least
Power braking	none	full power	full power
Approximate life in years	30	15-20	30
Maintenance	lower	high	least
Fuel costs, per cent	100	50-75	50-75
Lubrication costs			
Per cent of fuel costs	10	20-30	less than 5
Water costs			
Per cent of fuel costs	10	small	nil
Starting effort	minimum	larger	larger

Discussion

R. Herold (Sulzer Bros.): Up to now, the steam locomotive has endeavored to defend its position against the inroads of the Diesel. Now, it is the Diesel locomotive's turn to be on the defensive. Whether the gas turbine locomotive will become a serious competitor for the Diesel locomotive depends on various factors.

The most important of these factors is availability. The high availability of the Diesel-electric locomotives makes it possible for a certain number of such units to replace a larger number of steam locomotives. The gas-turbine locomotive will have a high availability, due to the simplicity and serviceability of its components. As the gas-turbine locomotive will hardly ever be advantageous in switching service, let us consider only main-line operation. Reports indicate that in this kind of service, the average availability of American Diesel-electric locomotives is better than 90 per cent; in some instances it is 98 or even 100 per cent. Under such circumstances, the gas-turbine locomotive will not be afforded a chance to out-distance the Diesels. It may do just as well, but it can do no better. It appears therefore that availability is not a factor in competition.

With regard to first cost, the gas-turbine locomotive has the advantage. Mr. Sidler has quoted a price of $87 per hp. for the Diesel-electric locomotive. But Mr. Sidler's figure of $65 per hp. for the gas-turbine locomotive is an assumption. The price difference between the two types may not be as high as $22.00. Moreover, the price of Diesel-electric locomotives can be reduced by redesign. At the present time, the competing American designs follow the same general patterns; this may not necessarily remain so.

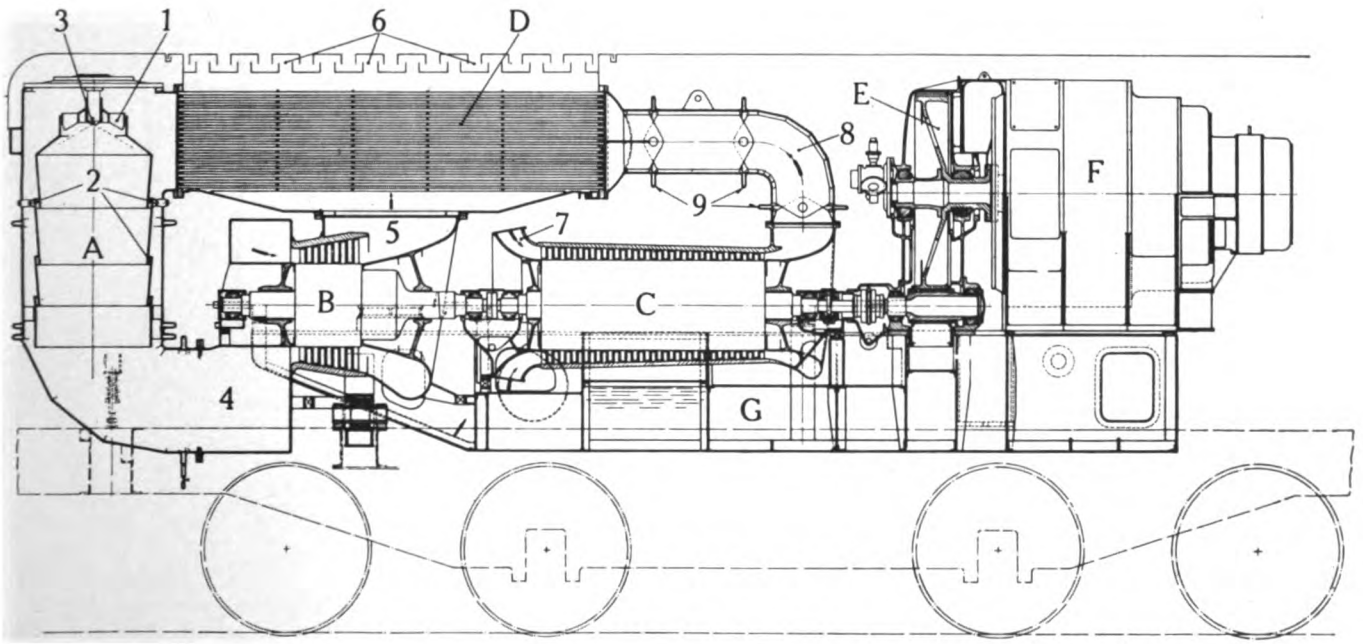


Fig. 3—Arrangement of the several elements of the power unit in the locomotive

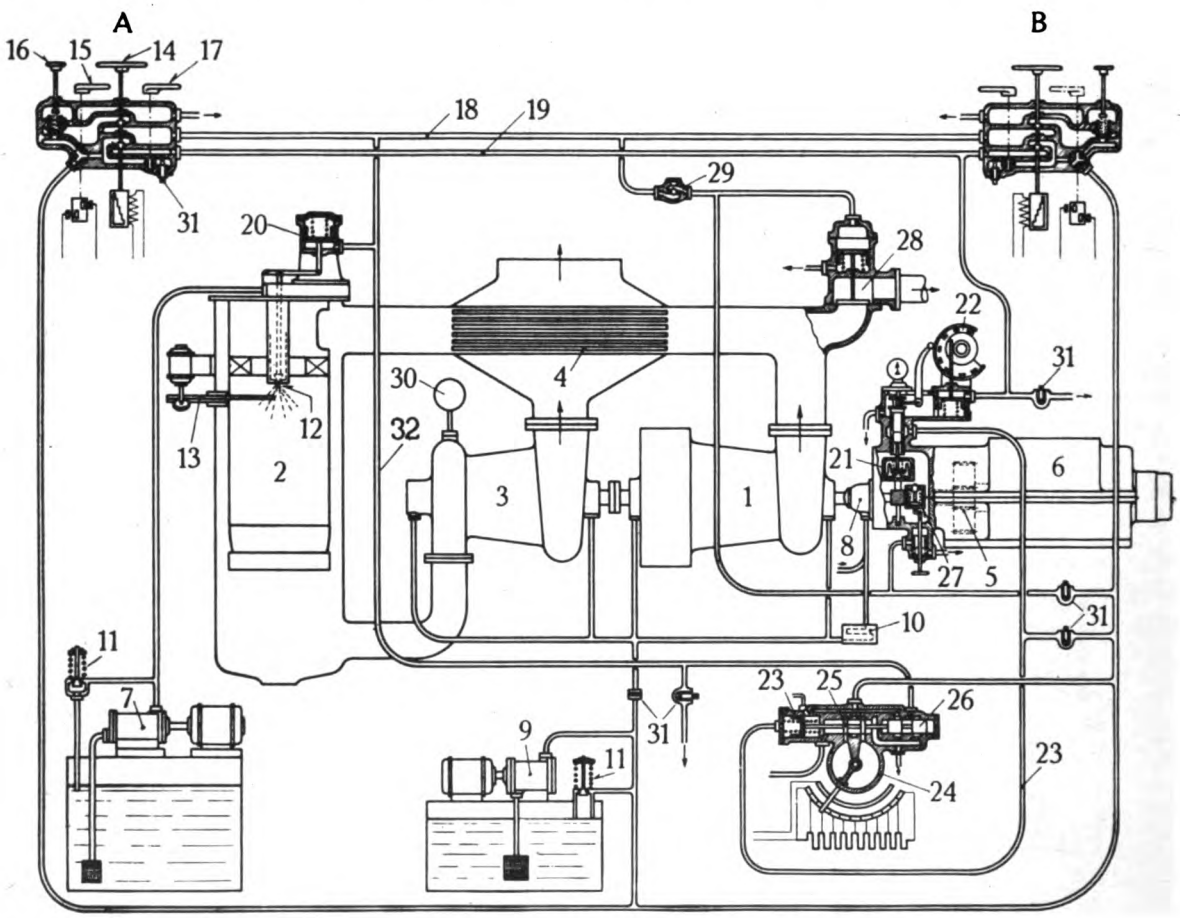
The higher first cost of the Diesel-electric locomotive is compensated by its lower fuel consumption or, in other words, by its better thermal efficiency. Under test conditions, a Buchi supercharged 4-cycle locomotive Diesel engine has a thermal efficiency of 38 per cent, or even better. Through the use of suitable control arrangements, this figure can be maintained from full load to one quarter load. The gas-turbine has, under test conditions and at its best point, a thermal efficiency of 17 per cent maximum. At part load, this efficiency drops rapidly, at one quarter load it is only 10 per cent. Therefore, the gas-turbine uses, at its best point, more than twice as much fuel as the Diesel. Even if the gas-turbine should be able to burn lower grade fuels than the Diesel—which is open to question—it could hardly run as economically as the Diesel. The efficiency of the gas-turbine can of course be increased by various recuperators, but these devices would increase the first cost of the locomotive, and the gain in operating economy would be compensated by higher amortization costs.

Lubricating oil consumption is a point which is all in favor of the gas turbine, even if Mr. Sidler's figure of 5 per cent of fuel cost is misleading because fuel consumption of the gas-turbine is more than twice that of the Diesel. Lubricating oil consumption figures for some types of Diesel-electrics are surprisingly high.

A point against the gas-turbine locomotive is its sensitiveness to the temperature of the ambient air, or intake air. It is, of course, the compressor which is responsible for this situation. The horsepower absorbed by the compressor and developed by the turbine are a multiple of the net power obtainable at the coupling. This entails that a slight drop in the efficiency of the compressor will noticeably reduce the net power and the over-all efficiency. If the power of the gas-turbine locomotive is taken as 100 per cent at 68 deg. F., it drops to 77½ per cent at 100 deg. F., whereas for the Diesel the difference is only 5 per cent. As, in this country, a locomotive must unavoidably operate under climatic conditions which vary a great deal, it follows that the design must be based on the most adverse conditions that may be encountered, and from this it follows that the gas-turbine locomotive must be over-dimensioned 20 per cent for normal conditions.

Summing up, the gas turbine locomotive in its present stage of development appears to have the following main advantages in comparison with the Diesel electric locomotive; lower first cost, greater simplicity, lower lubricating oil consumption. The disadvantages are: high fuel consumption, unfavorable operation at part load, dependence on temperature.

The coming years will no doubt bring many heated



A-B—Engineman's cab
1—Compressor
2—Combustion chamber
3—Gas turbine
4—Air preheater
5—Gear set
6—Generator
7—Fuel oil pump
8—Control and lubricating oil pump
9—Auxiliary pump
10—Oil cooler
11—Pressure limiting device
12—Fuel-oil nozzle
13—Ignition rod with remote control
14—Main control wheel with double valve and excitation resistor
15—Reversing switch with oil cut-off device and removable handle
16—Temperature regulator
17—No-load speed adjustment
18—Control-oil system for the fuel oil
19—Control-oil system for the speed regulation
20—Operating piston for the fuel-oil nozzle
21—Speed regulator
22—Camshaft for the adjustment of the speed from the engineman's cab (operates the sleeve of the regulator *21*)
23—Field regulator hydraulic control line from *17*
24—Field regulator with rotating piston
25—Control piston for *24*
26—Piston controlling fuel-oil quantity during regulation
27—Safety speed regulator
28—Safety valve
29—Back-pressure valve
30—Safety temperature regulator
31—Oil trap

Fig. 4—Gas-turbine generating plant

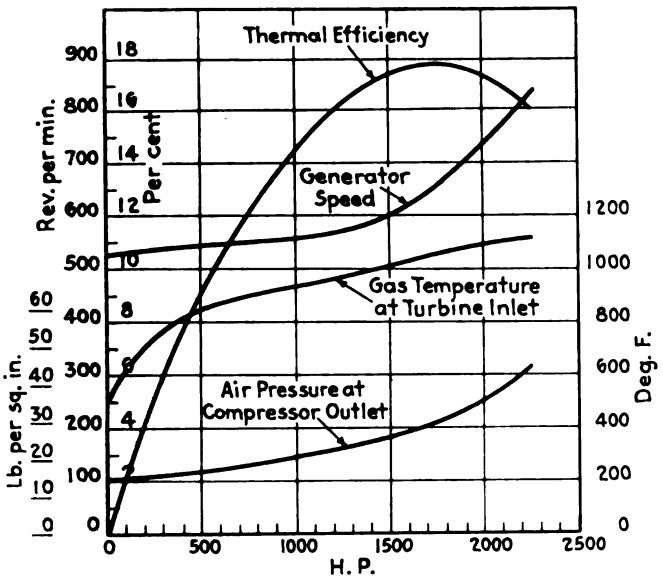


Fig. 5—Chart showing conditions relating to efficiency

arguments between the proponents of gas-turbine locomotive and Diesel locomotive. It is not impossible that, some day in a rather distant future, the two types will be merged into one. Now, already, the builders of the gas-turbine locomotive have made a small concession to Diesel manufacturers by installing a Diesel as a starting engine. On the other hand, many engines in Diesel locomotives have a small gas turbine, driven by exhaust gases. The relative importance of the two plants may become equal. The gas turbine plant wastes a great deal of energy in cooling the hot combustion gases to a temperature acceptable for the turbine blades. If the combustion were transferred into a compression-ignition engine, the loss in thermal energy would be much smaller. In a recent paper, Mr. F. Oederlin of Sulzer Bros. has referred to an interesting case in the development of the supercharged two-cycle engine; when supercharged to 85 lb. per sq. in. the engine develops just enough power to drive the supercharging compressor and it does not deliver any power at the coupling. Such an engine is nothing but an efficient producer of hot gases; the high temperature part of the combustion and expansion process takes place in the Diesel and is used to drive the compressor, while the lower part takes place in the gas turbine. The Diesel with compressor corresponds to the boiler of a steam plant. A certain number of such "boilers" could feed a single turbine driving a single generator. Such a multi-engine locomotive plant would correspond to the solution which P. B. Jackson of the Aluminum Company of America has suggested. But, as emphasized before, this solution is by no means just around the corner and it will require a great deal more research work.

J. T. Rettaliata (Allis-Chalmers): The operating data, presented by Mr. Sidler, are fairly complete but I would appreciate being informed of the amount of surface used in the heat exchanger as well as the pressure drops on the air and gas sides, and the overall heat transfer coefficient obtainable.

In this country Allis-Chalmers has conducted an engineering study[1] of the gas turbine as a drive for locomotives of larger output than that discussed by the author. Various arrangements have been considered including electrical and hydro-mechanical transmissions, with the latter type appearing to have certain weight and efficiency advantages. The study indicates that a 5,000 hp. gas-turbine locomotive with hydro-mechanical transmission would have a total operating specific weight of 112 lb. per hp. at the axle and would be capable of speeds up to 120 m.p.h.

Mr. Sidler gives a maximum service weight of 101 tons or 202,000 lb. for the Brown, Boveri gas-turbine locomotive. With an assumed efficiency of 85 per cent for the electrical elements of the transmission the total service specific weight for this locomotive is 108 lb. per hp. at the axle. Even though the locomotive used in the Allis-Chalmers study is designed for a maximum speed of 120 m.p.h. it can be seen that its specific weight is close to that of the Brown, Boveri locomotive which has a maximum speed of 70 m.p.h.

In the interest of weight reduction and also to achieve more uniform distribution of weight, the power plant of the locomotive studied by Allis-Chalmers has been divided into two units of 2,500 hp. each. In each unit a two-turbine design has been adopted—one turbine furnishes sufficient power to drive the compressor only, and the excess gas generated operates the other turbine, thereby providing propulsive power to the locomotive. The use of separate turbines improves the partial load performance since the compressor and its driving turbine can operate independently at their optimum speed regardless of the speed of the locomotive.

The hydro-mechanical transmission, consisting of a torque converter and hydraulic coupling for low and high speeds, respectively, affords a high tractive force at starting without a sacrifice in maximum speed. Control of the locomotive speed is accomplished by a combination of manual and governor regulation of the fuel burned in the combustion chamber and also by throttling the gas supplied to the power turbine.

The transmission for each turbine consists of two sets of torque converters and hydraulic couplings so that each driving axle of a truck has its connected set. Thus the individual hydraulic units, which operate at 1,535 r.p.m. when the locomotive speed is 90 m.p.h., are about three feet in diameter and transmit about 1,200 hp. each. Accordingly, they do not exceed either in size or speed similar units which have been built previously.

The tractive force of the locomotive, at the drawbar, at starting is 78,000 lb. while at 100 m.p.h. it is 11,000 lb.

Mr. Sidler: I have no accurate information on the surface of the heat exchanger. I can, however, mention the temperature conditions in this air preheater in the hope that this will at least partly answer the question. At full load of the gas turbine the air temperature is increased from 201 to 284 deg. C., while the temperature of the gas through the preheater decreases from 366 to 279 deg. C.

From the figures shown in Table II it can be established that the average efficiency of the electric generator for the varying load during the run is between 91.5 and 92 per cent. This machine is built according to the latest practice for railroad equipment and certainly has a full load efficiency around 95 or 96 per cent.

With reference to Mr. Herold's questions on efficiency, fuel costs and influence of air temperature, the following comments are made:

The sloping efficiency curve of the gas turbine at partial loads is, of course, an inherent characteristic of turbo-type machinery. I have already indicated in the paper that data have been developed for improving this situation. Such an improvement will consist in operating the gas turbine at higher inlet gas temperature at partial loads. In this manner the efficiency at these points can also be improved and a flatter curve obtained.

(*Continued on page 79*)

[1] "An Engineering Study of the Combustion Turbine Locomotive," by J. L. Ray, Allis-Chalmers Bulletin No. B-6066, Sept. 6, 1939.

Locomotive Inspection Report

Annual report of the Bureau to the I. C. C. calls attention to the increase in defects found—Thorough inspection and repairs needed to assure accident prevention

IN the annual report of the Bureau of Locomotive Inspection submitted by Director John M. Hall to the Interstate Commerce Commission for the year ending June 30, 1942, there are many indications of the pressure under which the railroads are operating at the present time. Particularly with reference to steam locomotives there has been a noticeable increase in defects, as well as in accidents and casualties. While reports were filed for 285 fewer locomotives in 1942 than in the previous year the activities of the Bureau's inspectors were reflected by the fact that 7,776 more inspections were made and 1,400 more locomotives were found defective, an increase of one per cent over 1941. While 7,237 defects were found on the locomotives inspected only 474 steam locomotives were ordered out of service as compared with 560 the previous year.

In the case of locomotives other than steam the number of units for which reports were filed increased, as did the number of inspections and defects found. The character of the defects, however, was such as to require fewer units ordered out of service.

In the matter of accidents and casualties the record for 1942 is not a favorable one for there was a decided increase, as shown by the accompanying tables.

Table I—Reports and Inspections—Steam Locomotives

	Year ended June 30					
	1942	1941	1940	1939	1938	1937
Number of locomotive for which reports were filed	42,951	43,236	44,274	45,965	47,397	48,025
Number inspected	113,451	105,675	102,164	105,606	105,186	100,033
Number found defective	10,970	9,570	8,565	9,099	11,050	12,402
Percentage inspected found defective	10	9	8	9	11	12
Number ordered out of service	474	560	487	468	679	934
Number of defects found	44,928	37,691	32,677	33,490	42,214	49,746

Explosions and Other Boiler Accidents

All of the 13 explosions that occurred in the fiscal year, in which 23 persons were killed and 18 injured, were caused by overheating of the crown sheets due to low water. There was an increase of two accidents, an increase of 12 persons killed, and a decrease of 11 persons injured from this cause as compared with the preceding year.

In three of these accidents, in which nine employees were killed and two employees and two passengers injured, the force of the explosions tore the boilers from the running gear and hurled the boilers and other parts for considerable distances from the points of the explosions. In another instance where the boiler was torn from the running gear and two employees were killed and one was injured, the accident occurred in a tunnel, the boiler struck the roof of the tunnel, and alighted on the front engine of the articulated running gear. In three other accidents, in which five employees were killed and four injured, the boilers remained attached

Table III—Reports and Inspections—Locomotives Other Than Steam

	Year ended June 30					
	1942	1941	1940	1939	1938	1937
Number of locomotive units for which reports were filed	3,957	3,389	2,987	2,716	2,555	2,416
Number inspected	6,728	5,558	4,974	4,581	4,024	3,615
Number found defective	358	319	298	260	274	328
Percentage inspected found defective	5	6	6	6	7	9
Number ordered out of service	12	21	16	14	9	24
Total number of defects found	928	905	766	696	769	991

Table II—Number of Casualties Classified According to Occupation—Steam Locomotive Accident

	Year ended June 30									
	1942		1941		1940		1939		1938	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
Members of trains crews:										
Engineers	10	79	5	41	5	70	4	46	3	70
Firemen	12	73	5	68	6	49	6	66	2	80
Brakemen	4	32	3	21	4	24	2	18	..	31
Conductors	..	7	..	8	1	4	..	5	..	6
Switchmen	..	5	..	6	..	4	..	6	..	7
Roundhouse and shop employees:										
Boilermakers	2	4	..	..	1	3	1	1	..	2
Machinists	..	5	1	3	..	3	..	2	..	..
Foremen	..	1	..	2	..	..	..	..	..	1
Inspectors	1	2	..	..	..	..	..	..	..	1
Watchmen	..	..	1	2	..	1	..	1	2	..
Boiler washers	..	..	..	..	..	..	..	..	..	1
Hostlers	..	4	..	3	..	2	..	1	..	6
Other roundhouse and shop employees	3	3	..	1	..	1	..	2	..	1
Other employees	2	3	..	9	1	20	..	2	..	3
Nonemployees	..	9	..	18	..	44	2	14	..	7
Total	34	227	15	182	18	225	15	164	7	216

to the running gears but the force of the explosions caused derailments. Three employees were killed and four employees injured in an accident that occurred while the locomotive was in the enginehouse; the rear end of the locomotive was lifted from the rails and displaced sidewise and parts of the enginehouse were wrecked. Four employees were killed and five employees injured in the remaining five accidents, in which the explosions were less violent than those described in the foregoing.

The serious results of boiler explosions are well known to railroad men and explosions have been materially reduced since the inception of the Boiler Inspection Act; however, there has been an increase in such accidents in the past two years with consequent increased loss of life and injuries and destruction of equipment.

Many locomotives are equipped with protective devices such as syphons, multiple drop or fusible plugs, and low-water alarms, all of which have no doubt prevented boiler explosions or minimized the severity thereof. Carriers that are continuing to make applications of devices of this character are making a distinct contribution to the conservation of human resources and equipment.

Boiler and appurtenance accidents other than explosions resulted in the deaths of seven persons and injuries to 65 persons; this is an increase of six deaths and 30 injuries as compared with the accidents of the preceding year.

Extension of Time for Removal of Flues

One thousand and seventy-nine applications were filed for extensions of time for removal of flues, as provided in Rule 10. Investigations disclosed that in 57 of these cases the condition of the locomotives was such that extensions could not properly be granted. Twenty-eight were in such condition that the full extensions requested could not be authorized, but extensions for shorter periods of time were allowed. Forty-six extensions were granted after defects disclosed by our investigations were required to be repaired. Twenty-seven applications were canceled for various reasons. Nine hundred and twenty-one applications were granted for the full period requested.

Locomotives Which Are Propelled By Power Other Than Steam

There was a decrease of two in the number of accidents occurring in connection with locomotives other than steam and a decrease of two in the number of persons injured as compared with the preceding year. No deaths occurred in either year.

During the year five per cent of the locomotives inspected were found with defects or errors in inspection that should have been corrected before the locomotives were put into use; this represents a decrease of one per cent compared with the results obtained in the preceding year. There was a decrease of nine in the number of locomotives ordered withheld from service by our inspectors because of the presence of defects that rendered the locomotives immediately unsafe.

Table IV—Number of Casualties Classified According to Occupation—Locomotives Other Than Steam

	Year ended June 30									
	1942		1941		1940		1939		1938	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
Members of train crews:										
Engineers	..	5	..	1	..	2	..	3	..	3
Firemen	..	2	..	5	..	2	..	1	..	..
Brakemen	..	1	..	1	..	..	..	1	..	..
Conductors	..	..	..	1	..	1	..	..	..	..
Switchmen	..	1	..	..	..	1	..	..	..	1
Maintenance employees	..	..	..	2	..	1	..	..	..	..
Other employees	..	..	..	..	..	..	..	..	..	..
Nonemployees	..	..	..	1	..	..	..	..	..	..
Total	..	9	..	11	..	7	..	5	..	4

Locomotive Boiler Specification Cards and Alteration Reports

Under Rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 312 specification cards and 8,241 alteration reports were filed, checked, and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found.

Under Rules 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 666 specifications and 316 alteration reports were filed for locomotive units and 99 specifications and 111 alteration reports were filed for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found.

Legal Matters

One case of violation of the rules and instructions for inspection and testing of steam locomotives and tenders and their appurtenances, comprising 17 counts, was pending in the district court at the beginning of the year. This case was dismissed upon compliance with the provisions by the carrier and agreement to avoid such violations in the future.

Special Work

In response to requests from military and naval authorities and other Government agencies engaged in the war effort, inspections of various locomotives and work equipment were made to determine the conditions and suitability for the respective uses, and cooperative assistance was rendered in other respects. These locomotives are being generally maintained to the standards prescribed by the locomotive-inspection law and rules governing the condition of locomotives used on the lines of common carriers and inspections are currently made by our inspectors.

No formal appeal by any carrier was taken from the decisions of any inspector during the year.

Table V—Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30					
	1942	1941	1940	1939	1938	1937
Air compressors	829	684	567	518	689	766
Arch tubes	27	31	20	28	66	105
Ashpans and mechanism	80	67	37	67	72	80
Axles	2	5	3	2	13	10
Blow-off cocks	238	205	191	204	226	199
Boiler checks	393	313	288	279	301	382
Boiler shell	290	271	266	272	331	347
Brake equipment	2,382	1,945	1,506	1,577	2,044	2,322
Cabs, cab windows, and curtains	1,163	1,087	1,078	943	1,226	1,807
Cab aprons and decks	335	307	277	260	326	466
Cab cards	131	97	101	92	109	145
Coupling and uncoupling devices	70	74	53	60	73	74
Crossheads, guides, pistons, and piston rods	1,273	858	815	739	905	1,160
Crown bolts	75	97	54	47	59	76
Cylinders, saddles, and steam chests	1,514	1,332	1,320	1,232	1,645	2,206
Cylinder cocks and rigging	521	438	447	418	585	729
Domes and dome caps	112	94	78	90	109	101
Draft gear	651	620	508	450	740	522
Draw gear	369	347	306	360	479	560
Driving boxes, shoes, wedges, pedestals, and braces	1,743	1,348	1,243	1,330	1,688	1,637
Firebox sheets	255	224	191	238	244	371
Flues	178	150	147	165	159	225
Frames, tailpieces, and braces, locomotive	869	863	665	708	1,001	1,053
Frames, tender	86	83	78	71	131	120
Gages and gage fittings, air	193	183	132	155	230	261
Gages and gage fittings, steam	263	236	211	226	279	324
Gage cocks	497	373	400	361	451	538
Grate shakers and fire doors	491	430	273	252	403	470
Handholds	378	433	333	349	405	510
Injectors, inoperative	47	39	30	26	26	38
Injectors and connections	2,220	1,882	1,330	1,457	1,784	2,020
Inspections and tests not made as required	8,186	7,215	6,218	6,645	8,204	9,638
Lateral motion	498	357	313	243	325	446
Lights, cab and classification	131	50	49	50	48	90
Lights, headlight	218	190	180	177	257	313
Lubricators and shields	234	196	185	200	212	254
Mud rings	244	187	213	248	203	272
Packing nuts	689	508	418	408	448	487
Packing, piston rod and valve stem	738	675	660	739	913	1,393
Pilots and pilot beams	188	142	140	104	154	133
Plugs and studs	173	156	156	179	238	238
Reversing gear	411	387	320	317	404	492
Rods, main and side, crankpins, and collars	1,986	1,565	1,199	1,293	1,669	2,348
Safety valves	67	68	61	97	125	132
Sanders	738	490	415	432	536	655
Springs and spring rigging	3,349	2,597	2,174	2,340	2,901	3,172
Squirt hose	67	62	50	75	94	133
Stay bolts	272	239	227	181	211	276
Stay bolts, broken	274	198	271	258	380	542
Steam pipes	290	385	255	285	410	446
Steam valves	150	110	106	115	141	165
Steps	594	555	449	490	631	678
Tanks and tank valves	1,150	952	768	837	955	1,009
Telltale holes	79	59	95	58	67	79
Throttle and throttle rigging	786	688	647	638	685	909
Trucks, engine and trailing	833	636	598	628	762	785
Trucks, tender	786	773	705	665	907	1,018
Valve motion	779	580	506	554	722	798
Washout plugs	569	445	478	487	626	598
Train-control equipment	7	1	2	5	11	12
Water glasses, fittings, and shields	1,133	788	753	690	915	1,049
Wheels	664	536	554	466	577	803
Miscellaneous—Signal appliances, badge plates, brakes (hand)	970	785	564	610	684	759
Total number of defects	44,928	37,691	32,677	33,490	42,214	49,746
Locomotives reported	42,951	43,236	44,274	45,965	47,397	48,025
Locomotives inspected	113,451	105,675	102,164	105,606	105,186	100,033
Locomotives defective	10,970	9,570	8,565	9,099	11,050	12,402
Percentage inspected found defective	10	9	8	9	11	12
Locomotives ordered out of service	474	560	487	468	679	934

Accident Prevention

Because of the increase in accidents Mr. Hall found it advisable again to place emphasis on the following portion of his report of last year:

The practice, still too often indulged in, of applying temporary repairs in the hope that the locomotive will make a successful trip and that more adequate repairs may be applied thereafter when the time is most convenient, has been productive of many failures on the line of road; these failures, in addition to increasing the peril to life and limb of employees and others and increasing the ultimate cost of repairs, result in delays to the trains involved and frequently affect the orderly movement of other trains. Avoidance of failures of locomotives on the line of road is an essential component of satisfactory railroad performance and it is therefore essential that the practice of applying temporary repairs of the character indicated be reduced to the absolute minimum.

Before a locomotive is started on any trip it should be known that all parts and appurtenances are in safe and suitable condition for service rather than to assume, as is sometimes done,

(Continued on page 79)

Table VI—Number of Locomotives Other Than Steam Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30					
	1942	1941	1940	1939	1938	1937
Air compressors	13	22	8	14	6	6
Axles, truck and driving	..	5	..	1	5	4
Batteries	1	6	1	1	1	4
Boilers	5	4	10	6	6	5
Brake equipment	86	69	50	50	74	97
Cabs and cab windows	27	45	22	36	25	51
Cab cards	20	24	13	18	11	25
Cab floors, aprons, and deck plates	10	14	17	13	8	17
Clutches	1	..	..	..	..	..
Controllers, relays, circuit breakers, magnet valves, and switch groups	12	7	16	13	7	8
Coupling and uncoupling devices	5	2	6	4	4	3
Current-collecting apparatus	1	3	1	5	8	4
Draft gear	19	15	31	17	23	28
Draw gear	3	3	2	4	3	3
Driving boxes, shoes, and wedges	16	36	29	52	16	14
Frames or frame braces	5	1	12	9	37	5
Fuel system	81	62	51	35	47	152
Gages or fittings, air	8	3	1	6	11	1
Gages or fittings, steam	..	..	2	..	..	..
Gears and pinions	4	2	1	2	2	2
Handholds	14	12	6	8	13	11
Inspections and tests not made as required	274	243	207	185	204	237
Insulation and safety devices	3	4	2	4	13	13
Internal-combustion engine defects, parts and appliances	62	54	35	32	26	50
Jack shafts	1	3	7	6	1	..
Jumpers and cable connectors	1	..	..	1	1	2
Lateral motion wheels	..	4	5	1	..	1
Lights, cab and classification	5	2	1	3	2	5
Lights, headlight	1	1	3	4	4	11
Meters, volt and ampere	2	..	4	2	2	1
Motors and generators	16	16	12	19	18	10
Pilots and pilot beams	10	12	10	6	1	7
Plugs and studs	..	..	..	..	..	1
Quills	6	..	4	7	6	3
Rods, main, side, and drive shafts	2	4	2	2	2	23
Sanders	57	56	34	28	37	52
Springs and spring rigging, driving and truck	35	58	50	16	43	36
Steam pipes	..	1	4	..	5	1
Steps, footboards, etc	21	35	22	18	23	13
Switches, hand-operated, and fuses	2	2	3	5	7	2
Transformers, resistors and rheostats	3	3	1	1	3	..
Trucks	28	30	43	33	40	41
Water tanks	1	1	..	1	..	1
Water glasses, fittings, and shields	5	1	1	1	3	..
Warning signal appliances	3	4	..	1	3	2
Wheels	43	28	22	16	11	21
Miscellaneous	14	8	15	10	7	20
Total number of defects	926	905	766	696	769	991
Locomotive units reported	3,957	3,389	2,987	2,716	2,555	2,416
Locomotive units inspected	6,728	5,558	4,974	4,581	4,024	3,615
Locomotives units defective	358	319	298	260	274	328
Percentage inspected found defective	5	6	6	6	7	9
Locomotive units ordered out of service	12	21	16	14	9	24

Experience with

Alloy Steels in Boilers*

By A. G. Trumbull†

THE requirements for large evaporating capacity in locomotive boilers have required the use of larger and larger boilers until a point has been reached where the boiler represents about 27 per cent of the total empty engine weight. In some of the latest freight locomotives the ultimate in weight per pair of wheels has been reached for existing track and structures. The weight of the boiler being so large a proportion of the total engine weight, possibilities are afforded for large weight reductions where the thickness of the plates can be reduced while maintaining the required factor of safety.



A. G. Trumbull

Nickel Steel as a Boiler Material

Among those railroads first to recognize the possibilities in this situation was the Canadian Pacific which realized the value of nickel steel as a material for boiler construction possessing substantially higher unit ultimate strength than the open-hearth carbon steel most generally employed for boiler construction. Subsequent to the use of nickel steel, silicon steel was offered as an alloy designed to accomplish the same purpose as nickel steel and this has been used to a limited extent in this country. The comparison of the physical properties of nickel and carbon steels will indicate the weight reduction which can be effected since this is directly proportional to the ultimate strength of the material. The properties of silicon steel are such that the average hardness range overlaps that of nickel steel so that for all practical purposes any rules for the fabrication of either of these steels would apply to the other.

The production of nickel steel entails some difficulties because of the extremely adherent scale properties of this material. This causes rough and pitted surfaces of large areas of the finished plate, a condition requiring special mill treatment in the rolling operations in order to avoid extreme pitting and consequently the possibility of a partial loss of the advantages gained from the higher tensile properties.

As is usual with any steel, the increase in tensile strength is accompanied by an increase in hardness and a loss in ductility. Reference to the table of comparisons shows that in the case of the two alloys under consideration, the hardness, as measured by the Brinell readings, is increased about 50 per cent over carbon steel, which naturally introduces difficulties in fabrication. Since with the termination of war it is probable that an era of great advancement in the mechanic arts will follow, we believe it can be anticipated that more attention will be given to efficiency in the design of all mechanical equipment, alloy steels for all purposes will be more generally employed, and, particularly, greater care will be exercised in order to insure maximum value from the use of carbon as well as alloy steels. The fabrication of alloy-steel boilers thus should become a subject of current interest in preparation for the probable extended future use of these alloys.

One of the important problems in locomotive boiler operation has arisen because of the phenomenon now known as intercrystalline corrosion, the cause and effects of which have been discussed at earlier meetings of the Master Boiler Makers' Association. Among the remedies advocated for the correction of this difficulty is a reduction in the stresses to which boilers are subjected both because of steam pressure and because of mechanical conditions arising during fabrication. The measures advisable to meet this condition are applicable whether carbon steel or alloy steels are used in the construction, but since alloy steels naturally involve higher unit stresses, consideration should be given in the design to a reduction of these stresses, particularly in the connection plates; that is, in the circumferential and horizontal seams which are the most frequent locations of difficulties from this cause.

Increased stresses permitted by the higher tensile strength of alloy steels suggested as the cause of aggravated intercrystalline corrosion — Effects of the increased hardness on fabrication of plates and the quality of driven rivets

The committee is of the opinion that all circumferential seams should be triple riveted and all horizontal

* The substance of a report on Topic No. 5 prepared for the 1942 year book of the Master Boiler Makers' Association.

† Mr. Trumbull, chairman of the Committee on Topic No. 5 of the Master Boiler Makers' Association, is chief mechanical engineer, Advisory Mechanical Committee, Chesapeake & Ohio, Cleveland, Ohio.

seams should be designed for relatively low efficiency. A reduction of stresses in these seams also can be effected through the use of carbon-steel instead of nickel-steel rivets. Not only can a reduction in stresses be thus obtained, but a more favorable condition for internal caulking of the horizontal seams results because of the possible reduction in rivet spacing in the outside rows of rivets in the inside welt strip. By low-efficiency horizontal seams is meant such minimum efficiency as will produce the required factor of safety with the customary allowances for deterioration.

The increase in hardness already mentioned introduces difficulties in fabrication involving skill, time, and material, all of which naturally increases the cost of production. In addition to the surface conditions already mentioned, alloy-steel plates have a glossy hard surface, difficult to penetrate, making it necessary to reduce the speed of the drills in order to maintain the necessary cutting edges and to reduce breakage. This condition is, of course, more pronounced with large holes—that is, holes above 1 in. in diameter. Thus, additional time over ordinary carbon-steel drilling is required, both for changing drills and for obtaining other drills newly ground. It should be observed here that an increase in the hardness of rivets requires higher driving pressures and these pressures in turn produce increased wall pressure on the rivet holes, thus tending to aggravate any tendency toward intercrystalline corrosion introduced by water conditions.

A Comparison of Physical Properties of Nickel and Carbon Steel

	Nickel Steel	Carbon Steel
Tensile strength, lb.	70,000-80,000	55,000-65,000
Yield, lb.	.55 Tens.	.50 Tens.
Elongation in 8 in., per cent	1,890,000 Tens.	1,500,000 Tens.
Reduction in area, per cent	3,600,000 Tens.	.....
Hardness (actual) Brinell	160-180	110-120

Difficulties of Using Nickel-Steel Rivets

In addition to other factors affecting rivet material, it should be observed here that experience with nickel-steel rivets has not been altogether satisfactory for reasons other than those mentioned. In certain applications that have been made nickel-steel rivets failed both in the shank and under the head. The exact reason for these failures was not determined, although a number of factors were present which might have been contributory to them. The rivets in question were heated with electric contact induction heaters which were operated at the lowest possible temperature. About 2 min. of heat were required for 1-in. rivets and 2¾ min. for 1¼-in. rivets, the temperature being controlled within a range of 1,500 to 1,700 deg. F. A check of these rivets as heated for driving showed those of the larger diameter running from 1,600 to 1,700 deg. F., although experience demonstrated that it was necessary to maintain the temperature as near as possible to 1,700 deg. The rivets heated to temperatures lower than this did not upset properly on the head end. These rivets were all driven on a bull riveter within a pressure range of from 70 to 97 tons, which was heid from 10 to 12 sec. During this interval it was necessary to run water on the dies to keep them cool and it is probable that some water ran over the rivet heads, thus producing a quenching effect which may have been responsible for some of these heads ultimately failing in service. Some of the rivets also cracked in the shank due probably to lack of uniformity in heating; that is, failure to obtain a good soaking heat such as could be produced by using coal, oil, or gas for heating purposes.

This experience indicates one of the difficulties encountered with alloy steel which requires greater care in heating and cooling than open-hearth steel. The condition of the interior of the rivet under the head is indicated in a general way by the hardness of the material which is indicated by the table at various locations in the head and shank of both defective and non-defective rivets selected at random.

Examination further developed as many as five or six fractures in the rivet shanks, a condition not present in the original rivets as manufactured which indicates that conditions responsible for the damage were created either in heating or in subsequent working.

Failure of these rivets in the shank and under the head naturally reduced their holding power, thereby permitting excessive movements of the sheets in the areas affected, thus contributing to the failures of the plates which followed. Experience with an identical boiler in which carbon-steel rivets were substituted for nickel-steel rivets has failed to disclose similar difficulties since no trouble has developed after twelve years of service under similar operating conditions.

Problems of Fabrication

The difference in hardness is also reflected in finishing the edges of the plates for caulking and, consequently, in the planing operation the cutting speed must be greatly reduced since the outer surface of the edge of the plates is extremely hard and tough due both to the material and to the condition produced by the cutting of the plates to the required size for planing. This naturally affects the cutting edges of the tools, which necessitates a frequency of grinding greatly in excess of that of tools used in planing carbon steel.

The harder material also involves greater care and a greater number of passes in the rolling operation, since it is necessary to avoid too rapid forming of the plates. This obviously requires more time with a consequent increase in the cost of the operation.

In flanging alloy-steel plates, whether by dies or by hand, it is necessary to use substantially higher tem-

Hardness Characteristics of Driven Nickel-Steel Rivets

A survey on longitudinal faces cut through the centers of two failed rivets and on longitudinal faces cut through the centers of two non-defective rivets—Readings taken on a Rockwell hardness tester "B" Scale and converted to Brinell.

	Average Brinell hardness values					
	From surface of head, in.			Base of head across shank	From surface of shank, ½ in.	Along center of shank
	⅛	⅜	⅝			
Failed rivet No. 1:						
Outside head	230	201	176	179	...	...
Inside head and shank	205	182	179	192	193	196
Average hardness, 193 Brinell						
Failed rivet No. 2:						
Outside head	211	191	177	197	...	...
Inside head and shank	200	186	181	186	190	190
Average hardness, 191 Brinell						
Non-defective rivet No. 3:						
Inside head	210	196	191	219*	...	...
Outside head and shank	186	177	175	184	194	204
Average hardness, 193 Brinell						
Non-defective rivet No. 4:						
Inside head	201	190	186	210*	...	...
Outside head and shank	194	179	173	179	189	191
Average hardness, 189 Brinell						

* Increased hardness due to work hardening when head was removed.

peratures, thus increasing the time of the operation about 20 per cent. If relatively high temperatures are not used, it becomes necessary to use two heats and two operations in pressing when die flanging is used, since the toughness of the alloy steel renders forming extremely difficult.

Where no dies are available for flanging, and the work is done by mauls, the length of time is greatly increased on account of the necessity for working the metal at high temperature which is necessary because this steel is more susceptible to failure when worked at low temperatures than is the case with carbon steel. The requirement for flanging at high temperatures reduces the available working time, since the metal cannot be worked below certain temperatures. This naturally involves a considerable increase in the heats for each plate, thus increasing the time and labor involved for the different flanging operations.

Greater care is also required in fitting the plates or parts together since, in order to secure a metal-to-metal fit within the prescribed tolerance of .003 in., each section of the plate must be heated and laid up closely by the use of flatters and mauls. These plates require greater care in fitting than is necessary with carbon-steel plates, making it necessary to apply temporary bolts in each hole in any seam that is being fitted in order that the plates may be firmly held in place until they have cooled off, since after heating for the setting-up operation the plates will spring apart when cooling begins. It can be readily understood that the use of plates requiring special heating and fitting naturally results in reducing the rate of production with a corresponding increase in the labor cost.

Progress Report on the Gas-Turbine Locomotive

(*Continued from page 73*)

An improvement in the full load efficiency of any gas-turbine power plant depends primarily on the availability of metals which will permanently stand higher gas temperatures and still can be machined by ordinary means. Due to the lack of such steel alloys for commercial purposes in Switzerland about three years ago—which lack continues to this day on account of the war—all the gas turbines built by Brown, Boveri in 1939 and since that time were designed for a maximum gas temperature at the turbine inlet of 1,112 deg. F.

Development work on materials which can stand higher temperatures has, of course, been going on for some time in various countries and has, no doubt, even been speeded up by the requirements of war production. It is thus a safe prediction that materials for higher temperature work will be commercially available after the war.

An increase in the allowable continuous gas temperature at the turbine inlet will immediately bring favorable results in the overall efficiency of the gas turbine. Not only will the temperature drop through the gas turbine and thus its output be increased, but at the same time the quantity of air needed for cooling the hot combustion gases down to the temperature limit permissible for the turbine, will be proportionately reduced, thus also reducing the power consumption of the compressor. As the net output of the gas turbine is the difference between the power developed at the gas-turbine coupling and the power consumed by the air compressor, there will be a double gain from any allowable increase in the temperature and the overall-efficiency will increase at a rate about double that of the temperature.

It has been noted that the maximum thermal afficiency of the gas-turbine power plant on this locomotive is about 18 per cent at about three-quarter load. If a gas temperature of 1,500 deg. F. can be allowed at the turbine inlet, the thermal afficiency will immediately increase to 29 — 30 per cent, i.e. it comes very much nearer that of a Diesel-electric unit.

Mr. Herold doubts whether the difference in fuel cost between Diesel oil and Bunker oil is in the ratio of 2:1, but I have figures from a survey undertaken about fuel costs in the major ports of the world by several large European shipping companies, before the war started. This survey shows average fuel costs as follows: If the cost of bunker oil is taken as 1, the cost of gas oil is 2.09 and that of Diesel oil 2.26, all based on the same weight.

It is true that the net output of a gas-turbine power plant varies with the temperature of the surrounding air. This is particularly due to the inherent characteristics of the axial compressor. Its power consumption increases with the air temperature thus leaving a smaller effective output of the power plant, but the reverse is also true. When the gas-turbine locomotive is operated during winter time with its lower average air temperature, the extra output obtained from the gas turbine will be more than sufficient for electrically heating the entire train. On railroads where electric train heating is not in general use this extra energy could, of course, easily be converted into steam through an electric boiler installed on the locomotive.

On runs across high mountain ranges the gas turbine will again develop more power as it reaches higher altitudes, which is a most desirable feature for negotiating the grades. For example; if the net output of the gas turbine is 2,000 hp. at 68 deg. F air temperature, it will be about 2,600 hp. at 32 deg. F. and about 3,280 hp. at minus 4 deg. F.

Locomotive Inspection Report

(*Continued from page 76*)

that if the locomotive arrived under its own power it can go out again. All parts to which repairs have been made, the condition or capacity of which may not be determinable by visual inspection, such as air compressors, injectors and feedwater pumps, should be appropriately tested for the output required under service conditions in addition to the usual examinations made when a locomotive is being prepared for service, since mere observation that these parts "work" when a locomotive is at the terminal is not sufficient to determine whether or not their capacity has been restored. In investigations of accidents we sometimes find reports on the defect that caused the accident repeated many times until failure eventually occurred, together with signatures on the reports indicating that the reported work had been done, or at least that repairs to the reported defects had been attempted each time a report was made. This is proof that the safe repairs required to secure dependable operation of the locomotive had not been made and that labor and time had been wasted.

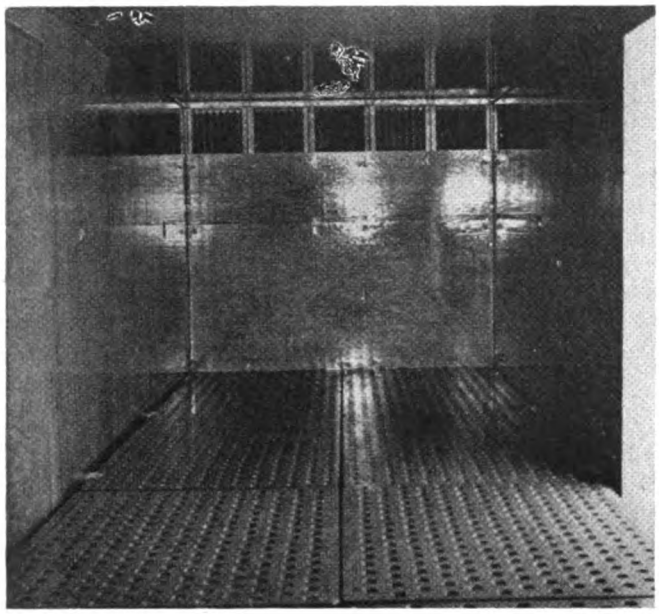
Complexity of the various appurtenances installed on modern locomotives, coupled with the placing in service of a large number of older locomotives which have been out of service for periods ranging up to 10 years or more, many of which are practically obsolete and therefore not well adapted to the giving of satisfactory performance under present conditions, and the intensive use of all locomotives now in service necessitate increased vigilance on the part of all concerned.

[The report included recommendations for salary increases for the director, two assistant directors and the district inspectors; also for the provision of five additional district inspectors.—EDITOR.]

Plywood Refrigerator Cars*

By Harry A. Dodge†

THERE is nothing new about the basic principles of plywood and they can be traced back to the ancient Egyptians. What is new is the technique of manufacture which, while producing in mass quantities, improves regular plywood from a product intended for uses such as kitchen cabinets into a plywood suitable for refrigerator



Refrigerator car built with plywood inside lining

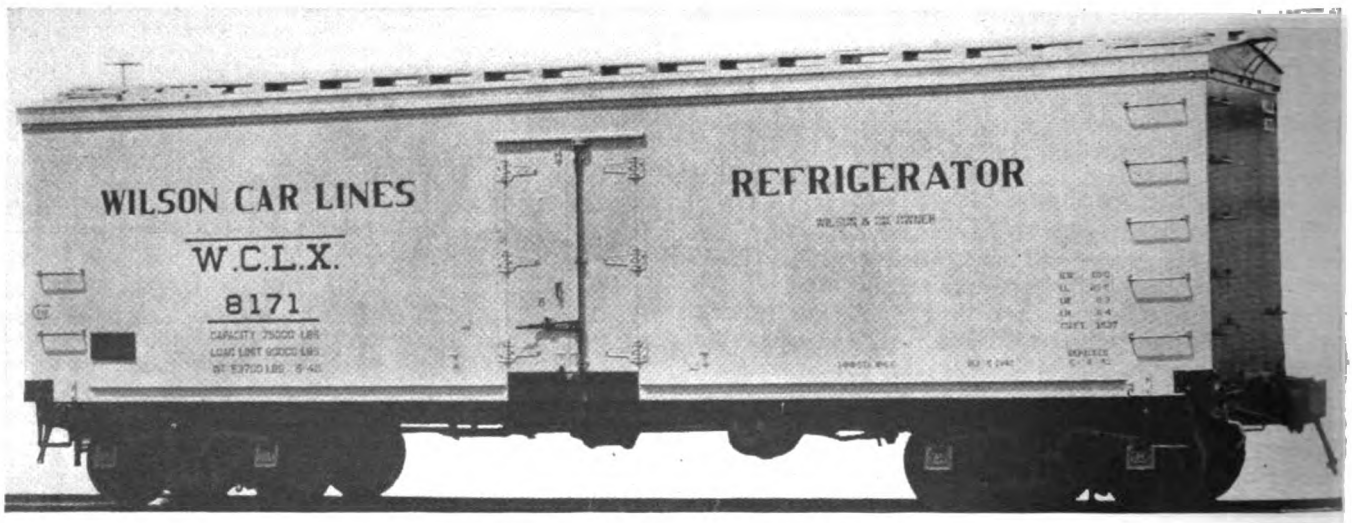
cars and heavy construction, including marine and other wartime exterior applications where it is for the present almost exclusively used.

The most important point in connection with the successful use of plywood in refrigerator cars or any railway equipment is that the proper type of plywood be selected. Plywood, regardless of type, of which there are many, consists of an odd number of veneers bonded together with the grain of each adjoining ply at right angles to the other and, although the appearance may be basically the same, we have to go into the technique of manufacture to really determine if it is suitable. A responsible plywood manufacturer has no desire to supply a plywood not intended for the use to which it will be put, and the manufacturer's recommendations should always be observed.

I am going to refer briefly to the basic technique used by the Harbor Plywood Corporation in manufacturing plywood in the Pacific Northwest, in accordance with the requirements for exterior type Douglas fir plywood in the United States commercial standards plus rigid individual requirements as set up by our engineers and production men. The manufacture of this plywood was first started in 1935, at which time applications were made to determine its performance in refrigerator cars. These applications were highly successful and, from that time on, progress has been rapid and performance has been almost beyond expectations. This plywood is the best that we can produce to resist decay and the effects of water and weather, and is a plywood of scientific development which comes more in the category of being an engineered lumber than just plain plywood.

How Plywood Is Manufactured

The logs are cut into desired lengths which results in what is known as peeler blocks. The peeler blocks are cut into veneer on a rotary-type lathe which revolves the peeler block against long, sharp knives. This action results in a flow of veener emerging from the machine in a continuous sheet in much the same manner as unwinding a roll of news print. Following this operation, the veneers are cut to desired widths in a clipper machine



Plywood refrigerator car built in 1940

* Abstract of a paper presented at the December 14, 1942, meeting of the Car Foremen's Association of Chicago.

† Sales engineer, Harbor Plywood Corporation, Chicago.

and subsequently dried to the proper moisture content. Particular care is given the drying operation so that the strength and the tenacity of the wood fibers are not damaged.

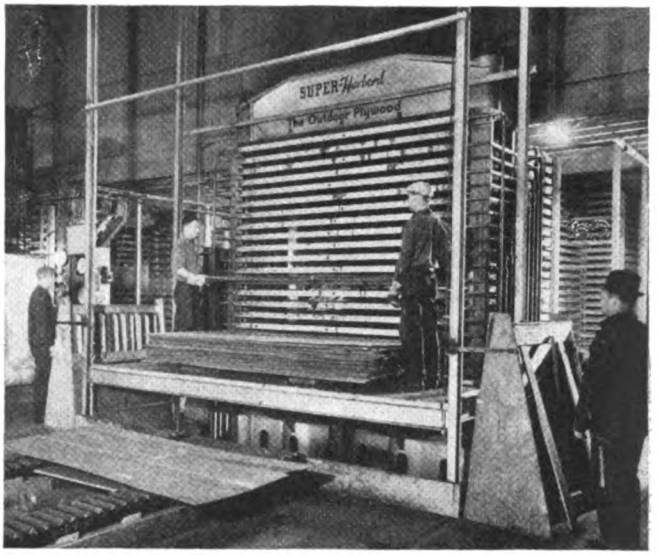
It is an accurately controlled system, insuring the uniform exhaustion of moisture and the setting of natural resins. The operations up to this point in the manufacture are basically the same, regardless of the type of plywood to be manufactured with the exception that the moisture content required and the thickness of veneer required for a given thickness of plywood are usually different.

To make the proper type of plywood, the most important operation, following the cutting and drying of veneers, is the laminating or fusing process. Under controlled conditions a weatherproof thermosetting phenolic or cresylic-formaldehyde-type synthetic resin is spread on the inner cross plies in a pressure-roll-coating machine. The panels are temporarily assembled and, following this, are put into giant hydraulic hot-plate presses, with each panel separated between hot plates. The pressure and heat in the press are applied simultaneously, and this causes the binder or resin to fuse the veneers together. The panels must be held in the press for a certain period under certain definite temperatures to properly fuse the resin. This lapse of time has a tremendous effect on production and cost, and it would be possible to shorten this time by the use of other types of resin, but we have not yet been able to get equal performance out of them. This, along with other operations, is done under full laboratory supervision and results in a bond which is unaffected by moisture and which is stronger than the wood itself.

Hot-Press Panels Must Be Tempered

It has been our finding that the hot-plate press operation often results in an unbalanced moisture content and, panels put into the field in this condition are subject to warpage due to contraction and expansion. In view of this, the panels are put through a tempering or humidification process where, under thermally controlled conditions, moisture is put back into the panel in such a way that it balances the moisture content between opposing veneers. This corrects the normal possibility of warpage and gives the panels proper moisture content, to permit the car builder to apply them without allowing for contraction and expansion.

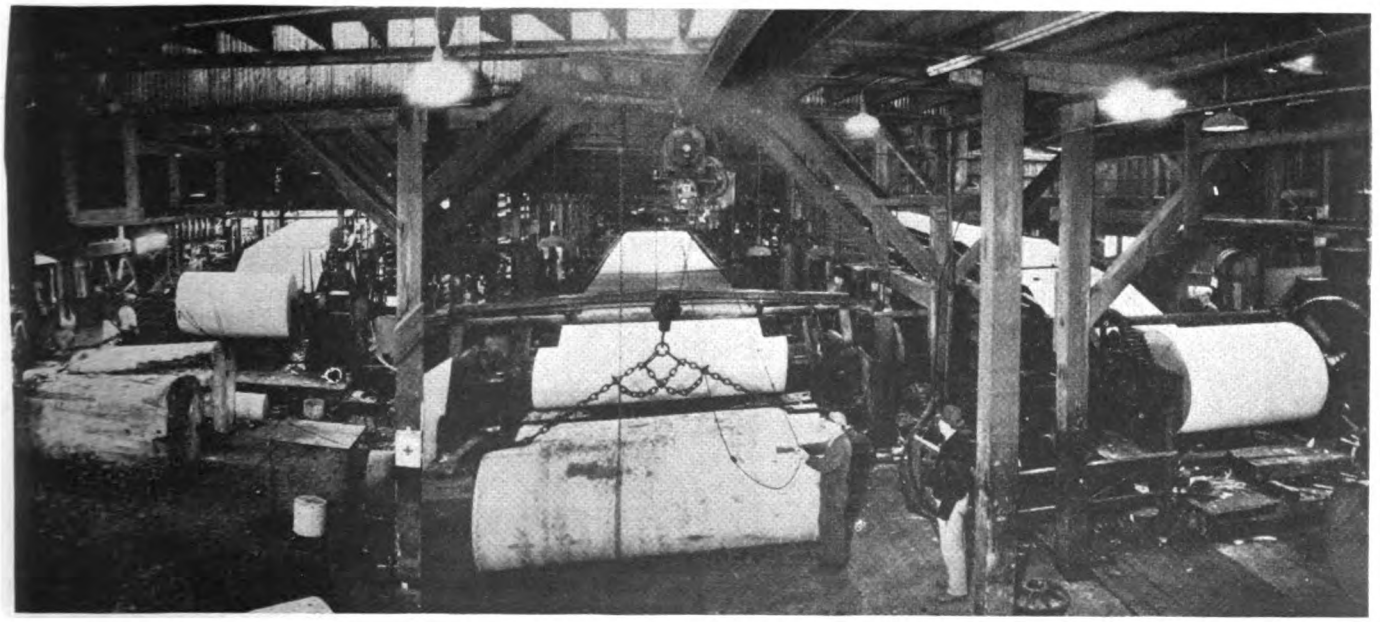
Following the humidification process, the edges of the panels are accurately trimmed to close tolerances, and the faces are sanded when specified. The final step is a very rigid and close inspection prior to shipment. These are conducted in the laboratory at regular intervals to determine performance. The edges of the panels, made under this process, are branded with the identifying, burned-in, trademark "Super Harbord," and a distinctive green binder line between the veneers serves as a protection for both user and manufacturer. By mutual cooperation, especially in the last five or six years, and a better understanding of each other's problems, the car builder has been able to develop his specifications and applications to better advantage, and the mill has been able to improve its product.



Hot-plate press used in making plywood panels

Kind of Plywood Used In Refrigerator Cars

Since Super Harbord plywood was first used in refrigerator cars, in 1935, there have been thousands of



The beginning of plywood—The log-peeling machine

additional applications for repairs to cars, and hundreds to new or rebuilt cars, in the latter cases, plywood being generally used for all-over construction. The performance of these cars has been watched closely and the differences in technique or system of application used by the various builders are slight. It is felt that even these slight differences will be eliminated as time goes on. We are encouraging standardization as nearly as possible, considering the many types of refrigerators in operation. Among those who have built all-plywood cars are the General American Transportation Corporation, Fruit Growers Express Company, Wilson Car Lines, North American Car Corporation, St. Louis Refrigerator Car Company, and the Pacific Fruit Express Company. The co-operation received from these concerns and many others using plywood has been highly gratifying.

Reports on the advantages of plywood in refrigerator cars are numerous and I will attempt to give you a brief outline of some of these findings. Because the material is wood, it has a low heat conductivity and is, therefore, a suitable material for refrigerators. It comes in large sheets, and it is possible to build with few or no unsupported joints, which ordinarily permit free passage of vapor. One company, building 40-ft. all-plywood cars, has eliminated 86.5 per cent of the linear footage of joints, compared with tongue and groove construction. This makes it an ideal housing for insulation because the insulation is kept in a dry condition. Also the type of resin binder used tends to reduce vapor transfusion through the material.

In still another program of all-plywood cars, the number of pieces per car has been reduced about 89 per cent and only 3.6 per cent as many holding screws and nails are required as in conventional tongue-and-groove construction. This elimination of parts greatly increases the strength of the car and reduces construction time.

Savings in dead haul weight of as high as 6,124 lb. have been made in 40-ton refrigerator cars, compared with conventional tongue-and-groove construction. This saving is due to a reduction in material weight and in the number of framing members previously required to give the car strength. As time goes on, it is possible that the weight reduction, through elimination of excessive framing, will be greatly increased. It is readily appreciated that large sheets of material, such as this, provide a diaphragm, or stressed covering type of strength, with which the weakness of excessive joints can be eliminated.

Refrigerator cars involving all-plywood construction have been built at costs comparable with conventional wood cars. In some parts of the cars, the cost of material may be slightly higher. Where this occurs, it can be offset by increased production and a lower cost for other car parts. In some details such as tank linings and roof structure, it has been possible to reduce greatly the thickness of material, compared with conventional wood construction, and at the same time give the car more of the type of strength it really needs. A sheet material properly applied, particularly in the roof structure and side walls is far more valuable, from the standpoint of strength, than heavy bulk thickness.

The Question of Repairs

The subject of repairs to damaged sheathing has come up, and the answer to this is to either replace the entire panel, or to make repairs to the damaged portion of the panel. New types of plastics are available which make it possible to permanently repair a surface scar without removal of the sheet. It is also possible to cut clear through the panel, removing the damaged part and repairing the panel without removing it from the car. This technique will be fully and more completely developed later, as it becomes necessary, and I am only making mention of the matter so that you will realize full consideration is being given the repair problem. We must keep in mind that this material is wood and that wood is always easily worked, and with just ordinary hand tools.

In addition to the applications to all plywood refrigerators, the car builders I have mentioned, together with several other leading companies, are making good use of the material in various parts of new cars, and in repair cars. Some companies find it more suitable for linings or top floors and others find it desirable for siding; still others for end bulkheads, depending upon their particular problems.

Plywood-Lined Cars Are Cinder Tight

Perhaps the most outstanding applications to repair cars have been the methods used to eliminate cinder leakage. This has been an important development and about five different companies are using the material for this purpose. In case, it is possible to remove the roof and get into the carlines of the car, the most acceptable method is to apply the plywood over the tops of the carlines, breaking the panel joints at a carline aproximately every eight feet. The panels are nailed in place at the carlines, center ridge and side plate and, because there are so few joints and none of them unsupported, it is unnecessary to take additional precaution. However, the joints are usually caulked with a suitable mastic, or other methods are used, as additional insurance against cinder leakage.

In the majority of cases it is impossible to remove the roof and make repairs along the lines I have described and, where this is the case, the most popular method is to apply a secondary ceiling of thin plywood direct to the old ceiling. The panels used are usually 48 in. wide and they are applied in one long length, stretching from side to side, extending over the side wall lining boards. A strip of paper is applied around all edges of the panels between the panels and the original ceiling. Short nails are used on about 12-in. centers intermediate and about 6-in. centers at the panel edges. This system, of course, does not keep cinders out of the car itself. However, it is found that it does, when properly applied, minimize leakage of cinders into the body of the car. I have made inspections of 40-ft. cars where after a comparatively short time it was necessary to use shovels and wheelbarrows in removing the cinders that would have ordinarily passed on to the lading and probably resulted in damage claims by shippers.

In other cases, as a precaution against cinder leakage, car builders remove the entire original ceiling and replace it with a heavier, more permanent thickness of plywood. This is usually applied in one long length from side to side with the cross joints breaking at the carlines.

[At the conclusion of his address, Mr. Dodge presented a patriotic all-color, all-sound moving picture, "Food For Total Security," recently made for the Harbor Plywood Corporation, which illustrated in a striking way the remarkable contribution of the railroads and private refrigerator car companies to the war progam by supplying food required for military forces and defense workers, as well as the balance of the civilian population. The film also showed at some length the technique used in constructing 100 all-plywood refrigerator cars in the Los Angeles, Cal., shops of the Pacific Fruit Express Company in the fall of 1940, and the application of plywood to the interior of a series of steel refrigerator cars.—EDITOR.]

EDITORIALS

Beware of the Empty Water Glass

In times of stress like the present carelessness finds many points in routine practice at which the defenses against its insidious pressure are growing weak. This is nowhere more serious than in connection with the handling and maintenance of locomotive boilers. The following message from John M. Hall, director, Bureau of Locomotive Inspection, therefore, seems to us of such importance to all railroad men whose duties require them to be around live locomotives that we place it among the expressions of opinion for which we are solely responsible.

During the first years of the operation of the Locomotive Boiler Inspection Act, a large number of boiler explosions occurred. However, due to the careful policing of the Bureau of Locomotive Inspection, as well as compliance with the requirements of the law and rules, locomotive boiler accidents decreased approximately 95 per cent until the fiscal year 1939 when but six boiler explosions occurred. Such accidents are now increasing and since July 1, 1942 to date, 17 explosions have occurred which resulted in the death of 14 experienced enginemen, firemen and trainmen, and seriously injuring 46 others.

Death or serious injuries are most regrettable at any time, especially to the person's immediate family, but when manpower is so vitally needed on our railroads these accidents are most unfortunate, and in addition the resultant damage and loss of service of locomotives to the railroads is also a most serious condition, the repairing of which consumes needed material and man hours.

Our inspectors make a most thorough investigation of all accidents coming under the law and that is especially true of boiler explosions. Our reports will show that crown sheet failures which resulted in explosions have been caused by defective fireboxes, mud and scale on the crown sheet, bad water, defective water glasses, etc., but the sad part is that most locomotive boiler explosions are due to low water.

Why does the water become low? Except in a few instances, no one knows why. It may be a mental lapse, or the engineman may be misled; for instance, he may mistake an empty water glass for a full one; the worn condition on the water side of reflex type glasses may fool him; the water glass lamp may not be properly located causing the glass to appear full or partly full, when it may in fact be entirely empty. The top water glass valve may be closed or the bottom connection stopped up. All experienced enginemen know that the water in the glass is never still if it is functioning properly. If the water is still the drain cock should be opened, the bottom water glass valve closed and if time permits, close the top valve, then close the drain cock and open the top and bottom valves the same amount of opening, if all is o.k., then the water should immediately return to the same height and move up and down with a slight movement.

Sometimes in a pinch an engineman will swap water for steam; two such cases which resulted in explosions occurred recently. In one case the locomotive was equipped with a low water alarm; the alarm whistle started to blow, the amount of water was increased in the boiler and the whistle stopped blowing; however, in a short time the low water alarm again sounded and presently the boiler exploded. In another case, the boiler was oil fired; the water was all used out of the tank, the locomotive was cut loose, leaving the train on a hill and locomotive moved light to a water station, the fire extinguished after arriving at the water plug, and after taking water the fire was forced and when the steam pressure increased to about 150 lb., the boiler exploded. In the first case two employees were injured, and in the latter case one was killed and two injured.

Two interesting cases where low water was involved came to our attention recently where the locomotives were equipped with thermic syphons; in one case the water receded to about 25 in. below the highest part of the crown sheet; the sheet did not fail and no personal injuries resulted; in the other case the water was down about 23 in. below the highest part of the crown sheet, but the sheet did not fail; however, due to one or two superheater flues collapsing and partly pulling from the back flue sheet two employees were injured by the escaping steam.

Regardless of the safety devices with which a boiler may be equipped, enginemen should not depend on them to prevent boiler explosions; the water glass and gauge cocks are for the purpose of keeping the engineman and

fireman apprised of the height of water in the boiler, and both should be equally interested in the amount of water in the boiler, *it should be a matter of mutual interest.*

The water should never be permitted to go out of sight in the glass, but if it should, never be so foolish as to close the top water glass to see whether water will show up in the glass. That is most foolhardy, as the bottom connection to the glass or column is several inches below the bottom reading, and so long as there is water at or near the bottom connection the pressure in the boiler will force the water to rise in the glass or column much higher than the actual height of water in the boiler.

Accidents resulting from failure of some part of appurtenance of the locomotive and boiler have increased 50 per cent during the past year; it is apparent that the war is affecting all of us mentally, whether we realize that fact or not, so let us take stock of our thinking and endeavor to be mentally alert at all times, especially when operating locomotives.

Aviators have coined a word for imaginary little spirits that cause plane wings to coat over with ice, stop up fuel or oil lines, etc., which they call "Gremlins." So brother enginemen and firemen, don't let the "Gremlins" fool you about your water—be alert.

A Limitation Removed from A. C. Welding

The development of new electrodes has entirely changed the status of alternating current welding. Whereas the a.c. arc was formerly difficult to use and limited in application, on some work it is now easier to use and there are only a few welding operations which can best be done with direct current. Users believe that a.c. will soon be suitable for all forms of welding.

This change was brought about largely by the production, last year, of a.c. welding electrodes which are satisfactory for welding in the vertical and overhead positions. The inherent advantages of the a.c. welder are thus made generally available. Probably the best feature of a.c. welding is the absence of magnetic disturbance known as arc blow which frequently gives trouble to the operator working with direct current. Other advantages are reduced power consumption (this may be as much as 45 per cent) and reduced maintenance. Since there are no rotating parts, wear is limited to plugs, receptacles and control equipment. Also since the welding transformer is a static device, insulation which will stand higher temperatures can be used.

The cost factor is also important. In small sizes, a.c. welders can be had which cost little more than half as much as d.c. machines. In larger sizes, the question of power factor becomes increasingly important, and it is desirable to include a capacitor. With the addition of the capacitor, the cost of the a.c. machine approximates that of the d.c. unit, but it must be remembered that the use of the a.c. machine has been limited. It requires less material, and if the quantity produced is increased, a reduction in cost should be possible. No one now using d.c. machines will scrap them for a.c. welders, but it seems certain that the percentage of the latter will increase as replacements become necessary and the use of welding is extended.

Signs of Strain

Never before have so large a proportion of freight cars and locomotives been in serviceable condition as during 1942. The number of freight cars undergoing and awaiting repairs was less than 4 per cent of the cars on line throughout 1942 and fell below 3 per cent after the middle of September. It reached a low of 2.4 per cent during the last half of October. The highest percentage of steam locomotives awaiting repairs was 8.6 in February and this came down steadily during each succeeding month to 5.4 per cent in December.

But these percentages leave the question as to the trend in the average condition of the cars and locomotives in service. Are equipment units being continued in service beyond the normal mileage for rebuild or classified repairs? Are running repairs being taken care of currently?

In the annual report of S. N. Mills, director of the Bureau of Safety of the Interstate Commerce Commission, there are three studies which throw some light on the condition of freight cars. The most direct is the per cent of freight cars inspected which were found defective. During the fiscal year ended June 30, 1942, the percentage was 2.55, an increase from 2.46 during both of the two preceding years.

Another index is the number of cases of train and engine crews remaining in the service more than 16 consecutive hours due to mechanical defects in cars. These cases increased from 55 in 1941 to 271 in 1942. Considering air brakes alone, there has been a steady increase in the number of cars set out and in the number which had to be repaired in trains per 100 cars inspected as the result of terminal tests before the departure of freight trains. These two groups combined amounted to 1.32 cars in 1940, 1.65 in 1941, and 1.65 in 1942.

In the annual report of the Bureau of Locomotive Inspection the percentage of steam locomotives inspected and found defective increased from 11 in 1940 to 12 in 1942. The number of defects per defective locomotive increased from 3.82 to 4.00. The percentage of locomotives other than steam inspected which were found defective increased from 7 in 1941 to 9 in 1942. The number of defects increased from 2.8 per defective locomotive in 1941 to 3.02 per defective locomotive in 1942. More significant than these comparisons, however, is a comparison of the number of defects by classes for the past two years. With an increase of 7.4 per cent in the number of locomotives inspected,

there was an increase in the total number of defects of all classes of 19 per cent. Among the large classes of defects, showing rates of increase much higher than the average are crossheads, guides, pistons and rods, 48.3 per cent; water glasses, water-glass fittings and shields, 43.8 per cent; driving boxes, shoes, wedges, pedestals and braces, 29.3 per cent; springs and spring rigging, 29 per cent; and main and side rods, crank pins and collars, 29 per cent.

Taking together all of the statements in the report of the Bureau of Safety which bear on the car conditions, the trends are not sufficiently pronounced to justify the conclusion that there has been any appreciable decline in the average physical condition of freight cars.

In the case of locomotives, the evidence suggests that some decline in the general condition of locomotives had already set in prior to June of last year. This is quite definitely the result of a slight dropping behind in current running repairs and there is some suggestion of a lowering of conditions as the result of mileage extensions between classified repairs. Considering the continued high standard of performance of locomotives during the last half of the calendar year 1942, it is evident that the standards of physical condition of motive power are still high but they must be watched closely.

How Are We Doing?

Just how the railroad man could get along without statistics is hard to imagine. He uses them to prove that he is right and the other fellow is wrong; his boss uses them to prove that things are not going as well as they should and when the going is tough as it is these days, these same good old statistics are often used to provide the consolation that some people need to convince themselves that they are doing well enough.

Take fuel records, for instance. The railroad man has looked upon the figure of pounds of coal per 1,000 gross ton-miles as the measure of the state of things concerning the use of locomotive fuel so long that it will probably be considered rank heresy to question the value of such a figure. The man whose railroad has a fuel figure way down in the 70's or 80's is, like his brother on the golf course, a person to be cultivated in order that one may find out what system he uses to arrive at the place where he can look down off the end of his nose at his less fortunate railroad brethren whose score is up in the 120's or the 140's.

We ran across a fellow the other day who was all riled up because someone had taken a pot shot at the fuel performance record of his railroad and cited his own road's low figure to prove how much better things were over on the XY&Z. Not being the kind who takes things lying down he set out on a campaign to prove that the other fellow wasn't so good either. His research into the question of fuel statistics led him to the early conclusion that if a road had enough gross ton-miles it wouldn't make much difference how much fuel was wasted—one would still have a favorable showing when the lb. per 1,000 GTM figure came out. Further investigations led to another conclusion to the effect that fuel accounting methods left much to be desired if one were trying to determine how efficient the performance might be on individual freight-train runs. So, finally, in desperation he appealed for help in his problem.

The statisticians came up with the accompanying table but like the proverbial prevaricators who toy with figures they couldn't make this one prove that pounds of coal per thousand gross-ton miles had any relation to the efficiency with which fuel was being handled or fired. Here was a problem, indeed: a set of railroad figures that couldn't be used to prove anything you wanted them to prove no matter which side of the

Fuel and Locomotive Performance—Eight Typical Railroads

Road No.		Fuel per 1,000 GTM lb.	Tons of Fuel Used	Loco. miles (000)	Gross ton-miles (000)
1	1938	99	225,460	2,838	586,017
	1942	93	411,092	4,432	1,110,831
	Increase	...	83%	56%	90%
2	1938	96	719,452	6,288	1,815,144
	1942	91	1,198,724	9,104	3,104,383
	Increase	...	66%	32%	71%
3	1938	97	165,594	2,086	466,811
	1942	84	228,262	2,492	667,311
	Increase	...	38%	19%	43%
4	1938	102	2,459,405	24,363	5,467,941
	1942	93	4,398,328	37,689	9,472,468
	Increase	...	80%	55%	75%
5	1938	86	399,731	4,343	984,823
	1942	85	864,037	7,792	2,040,950
	Increase	...	116%	80%	107%
6	1938	101	60,419	565	140,753
	1942	86	163,718	1,122	433,774
	Increase	...	172%	98%	208%
7	1938	76	941,835	7,505	2,239,380
	1942	71	1,407,503	10,548	3,493,446
	Increase	...	49%	29%	56%
8	1938	100	862,712	5,861	1,920,029
	1942	86	1,305,081	8,084	3,084,495
	Increase	...	52%	38%	60%

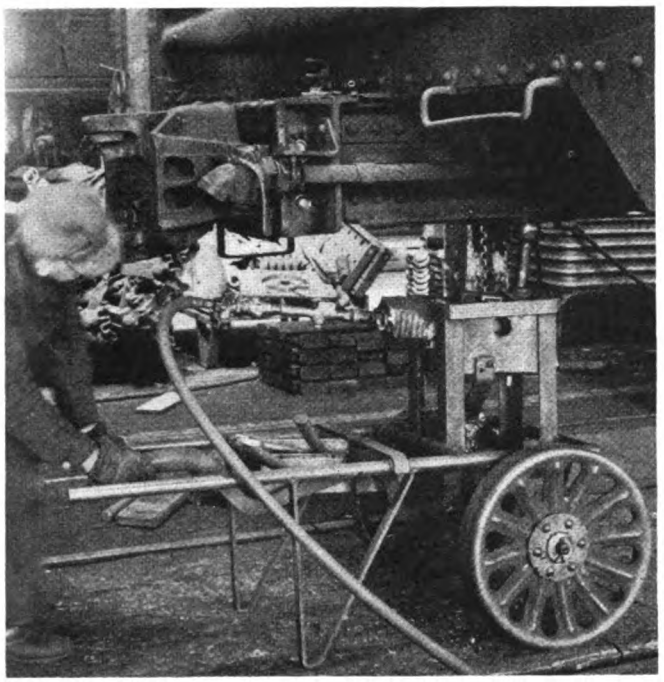
argument you are on. We give you these statistics for what they are worth, proof that if you want a good showing all that is necessary is to burn fuel efficiently and/or have enough business so that you have a good record as compared with some other road, or previous period, in the matter of the gross-ton-mile volume of traffic handled.

We have an idea that many railroad men are deceiving themselves these days with the consoling thought that, just because the fuel performance figures in pounds per thousand gross-ton-miles are going down, they are really doing a job in the matter of fuel conservation. It may be worth while to look into practices of fuel handling and fuel consumption on steam locomotives with a view to finding out whether, during a period of high traffic volume, fuel is not actually being wasted instead of being burned efficiently.

With the Car Foremen and Inspectors

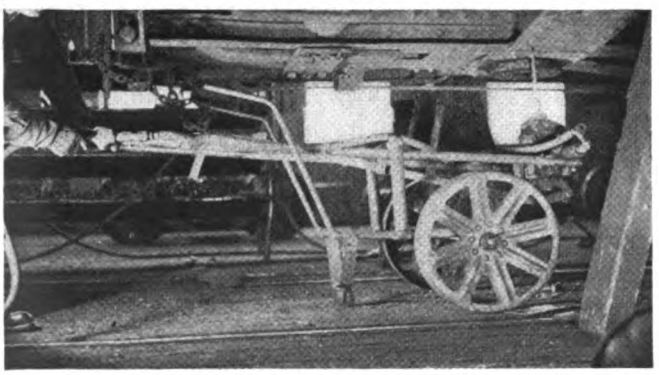
Portable Nut and Reamer Power Wrenches

The devices illustrated are in use in the shops of the Great Northern at St. Paul, Minn. One consists of an air-operated socket wrench for applying or removing the nuts from draft carrier bolts. This socket wrench operates in a vertical position and has a semi-knuckle joint and a high lift, controlled by the operator by means of a long lever. Several sizes of sockets are available.



Portable device for removing carrier-plate holding nuts

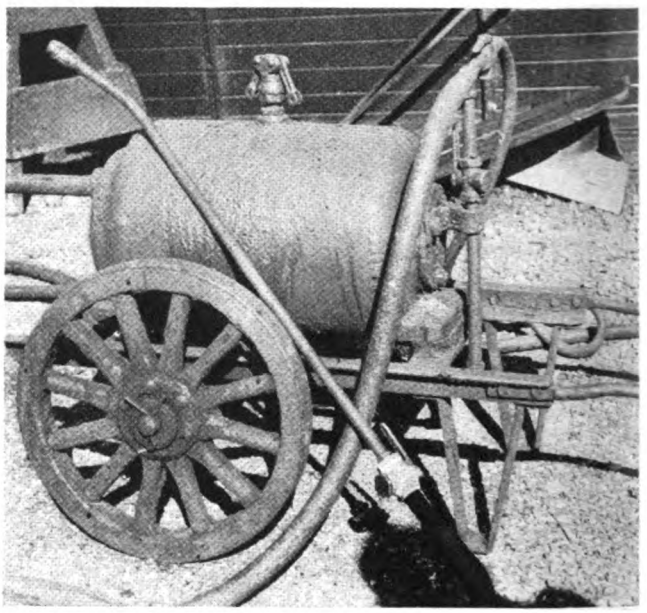
The portable remote-control air reamer is used for reaming center-plate and other underneath holes. The motor mounting has considerable flexibility and is controlled by means of a long lever arm shown next to the throttle at the operator's hands. The reamer can be entered in a hole, the motor started, and the handle of the truck pressed down to complete the reaming operation without the necessity of the operator going under the car.



Portable remote-control pneumatic reamer

Portable Unit for Spray Painting

A portable paint-spraying unit which can be built of scrapped or discarded materials has proved successful in operation at one car repair point. A discarded reservoir with its release valve, from a K-type brake was mounted on a carriage. A sealing plate was applied to the brake-cylinder connection. A pipe connection was then attached to the bottom outlet of the reservoir and a pipe line carried underneath the reservoir and through a bracket attached to the sealing plate. An angle cock is placed in the line at this point and then a tee connection. The yard air line attaches to one of the tee arms and the paint spray line to the other. An additional angle cock is placed in the paint spray line.

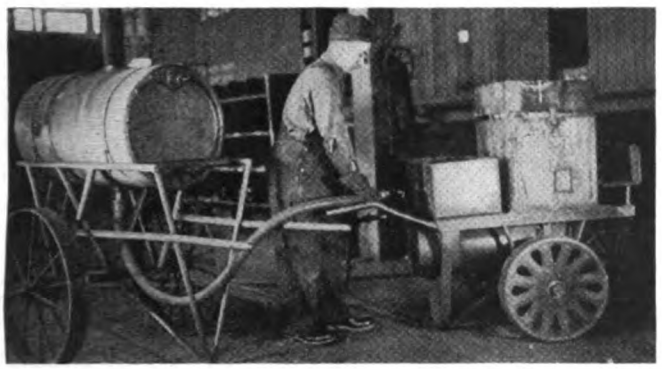


A paint spraying unit made from discarded materials

The reservoir is filled with paint through the opening made by the removal of the release valve. The capacity is ten gallons. After the tank is filled the paint spray line is closed at the tee connection and the line pressure of the shop's compressed air is admitted to the tank. When this has been done the paint line is opened at the angle cock and painting proceeds. When the paint in the tank has been used, the air line and paint lines are closed and the air pressure in the tank relieved by the opening of the release valve on top.

Refueling Furnaces Without Interruption

At the shops of the Great Northern at St. Paul, Minn., a large portable tank has been installed on a two-wheel truck, the frame of which is built up of the characteristic pipe sections used in the construction of many devices



A portable tank for refueling small forges

in the car department of that railroad. The high truck frame supports the tank at an elevation sufficient to permit the refueling of small forges and portable rivet heaters by gravity flow. These furnaces can thus be refueled without interruption of their service, and the hazard of filling the furnace tanks from cans is removed.

Some Problems of Tank-Car Maintenance*

By P. J. Hogan†

The carman's alertness is required to cover proper inspection and maintenance of equipment used in the handling of explosives and other dangerous articles by freight and express. His work in this respect reflects credit to him as records indicate that from 1926 to 1939, inclusive, the railroads of the United States hauled these commodities with a perfect record.

The use of tank cars on railroads has reached the peak at this time, and the carman's work has been greatly increased by the needs, inspections and maintenance required by these cars. Records indicate that considerable trouble has been experienced with older cars of this type, due to light construction of couplers, draft gears, brake rigging, excessive slack, neglected maintenance, decayed running boards, tank leakage, periodic air-brake cleaning and jacking and packing of boxes. The tank-car companies should assist the railroads in every way possible to accomplish minor repairs and adjustments to coupler operating levers and lock lifts, the adjustment of piston travel, the application of bolster-spring snubbers, etc. The railroads are working at top speed on repairs to this equipment in order to keep it moving.

The loading companies should do their work conscientiously by leaving the outlet cap off while loading to assure that the outlet valve is operating and tight against leakage. Many defect cards are being demanded by tank owners for loss of safety valves, a great many of them becoming loose and working off. Extreme care must be used by all concerned to guard against a condition of this kind since a spark from an engine is all that would be necessary to start a fire when a safety valve is missing.

It might be well for shippers to guard against freezing of outlet castings by the application of soft wood plugs as many cars will be loaded to the east this winter where temperatures are low.

It has been noticed that some companies are steaming out tanks which had contained gasoline for the purpose of making repairs without properly grounding the brass-pipe steaming apparatus with the tank. Rubber hose should not be used on account of static electrical effect when steam is passing from the hose into or against the tank shell.

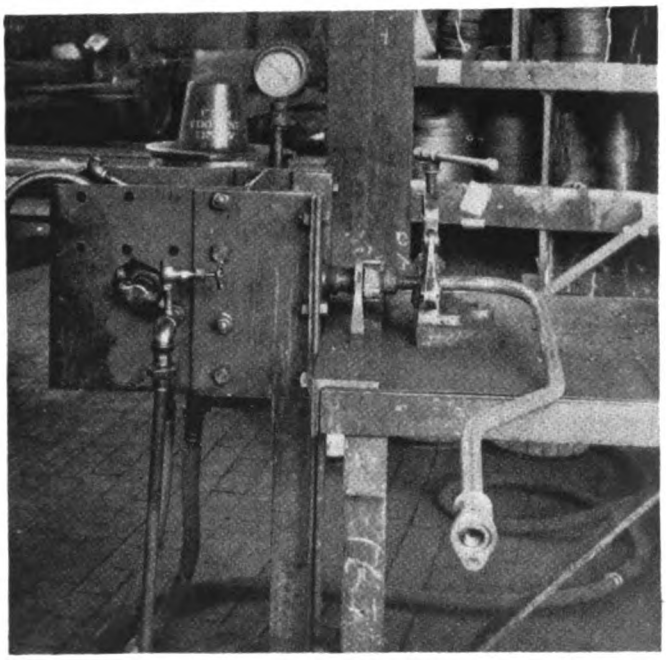
Approved electric lights should also be used on the inspection of cars whether loaded or empty as anything done to produce a spark at the opportune time is all that is necessary for fire or explosion with possible loss of life or property.

* Extract from a paper presented at the November, 1942, meeting of the Car Foremen's Association of Chicago.

† Supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.

Handy Shop Devices For the Air Brake Gang

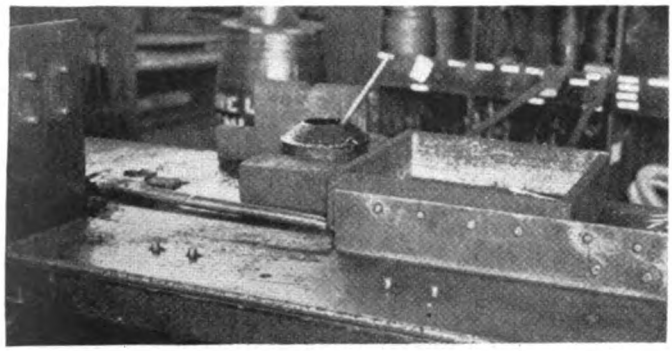
A flange applicator and a test rack to determine the fit of piping intended for use on AB brake parts have speeded up operations and eliminated the possibility of improperly bent pipe being sent to construction tracks.

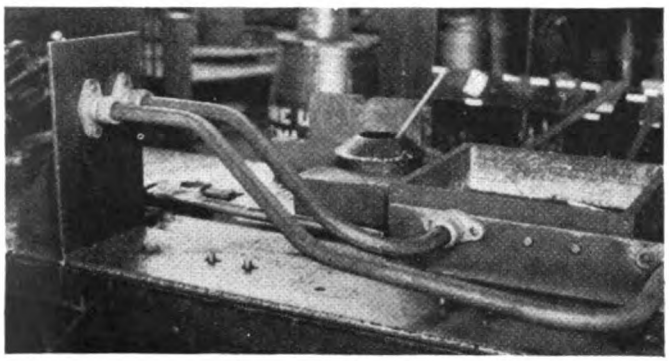


Pipe held in the vise ready for the application of a flange connection

The flange applicator is a simply constructed device which does away with much handwork and insures tight fits on all flanges applied to piping. The piece of pipe to which a flange is to be applied is clamped in a vise and a flange is placed on the head of an air-operated rotating spindle. As the spindle rotates it advances toward the pipe and, when the threads engage, the flange is run up tightly upon the threaded pipe end.

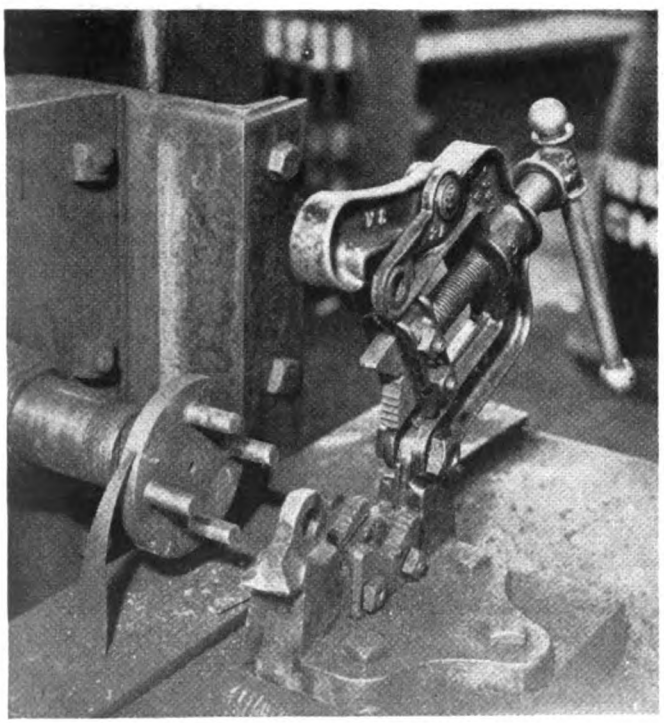
After removal from the flange applicator, all piping





Above: The test rack showing dowel pin arrangement to insure accuracy in pipe bends. Below: Pipe, with flanges applied, mounted on the test rack

is checked for accuracy of bends and proper flange application on the test rack which is also shown. Nipples are so located on this test rack that any of the smaller



Vise and flange holder spindle

bent pieces of pipe may be checked. If the holes in the flanges meet the dowel pins on the rack and the face of the flange is square with the surface of the rack, the prepared pipe section is certain to fit when it is applied on a car.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

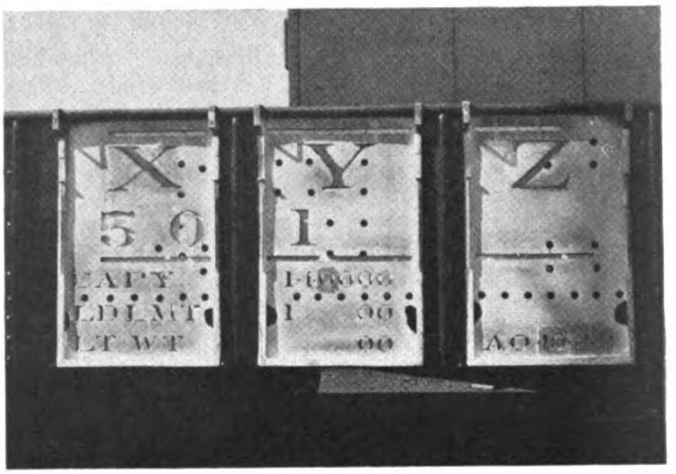
151—*Q.—Explain the operation of the F. S. 1864 or F. 1864 relay valve during an HSC brake application?* A.—At the F. S. 1864 or F. 1864 relay valve, the air from control-valve pipe *16* flows through passage *16* and strainer *17* to the magnet portion and to the diaphragm portion. In the diaphragm portion, the air from passage *16a* flows to the spring chambers of check valves *51, 51a* and *51b,* thence to chamber *A* on 40-per-cent diaphragm *60.* In the magnet portion, the air flows through passage *16b* to chamber *A* of the K-3 switch portion. At approximately 10 lb. pressure, diaphragm *4* of the switch is deflected against the tension of spring *9,* moving collar *6* and closing contact finger *20* across contact holders *28* and *28a,* thus closing the car battery supply wire to the speed-governor relays. The speed governor thereafter energizes or de-energizes the three magnets of the F. S. 1864 relay valve in accordance with train speed. At the inshot-valve portion, application air from passage *16c* flows past the supply valve *92* to chamber *C* on diaphragm *85,* thence to passages *15* and *15a.* From passage *15* the flow continues through chokes *138* and *140,* thence past upper magnet valves *161* and *161b* to passages *18* and *19,* passages *18a* and *19a* to the two diaphragm chambers *N* and *P.* When approximately 7 lb. pressure is obtained in chamber *C* of the inshot portion, inshot diaphragm *85* is deflected compressing spring *88* and moving piston *84* sufficiently to permit spring *94a* to seat supply valve *92,* cutting off further flow to diaphragm chambers *N* and *P.* The 7-lb. initial pressure inshot thus obtained in the diaphragm chamber is directly effective in chamber *P* where it acts on diaphragm *38,* overcomes the resistance of spring *42* and deflects the diaphragm, moving the relay portion to application position. The exhaust valve *23* and its piston *25* are seated by the lever *43,* and the application valve *32* and its piston *30* are opened, permitting the supply reservoir air to flow to the brake cylinders. This provides a low brake-cylinder pressure sufficient to take up the brake-rigging slack and apply the brake shoes to the wheels. After the inshot supply valve closes, the 7 lb. pressure in chamber *P* is retained, thus maintaining this inshot pressure directly on diaphragm *38* while further build-up or pressure in the diaphragm portion is controlled by the position of the magnet valves. At train speeds of less than approximately 20 m.p.h. the speed governor closes the circuit to the low speed (L.S.) magnet, energizing its coil which pulls down its armature and stem, thereby seating the lower magnet valve and unseating the upper magnet valve *161a.* Inshot air flows through choke *142,* past upper magnet valve *161a* through passages *17* and *17a* to diaphragm chamber *K,* thus balancing the inshot pressure on all diaphragms. With all lower magnet valves, *161, 161a,* and *161b,* closed, additional application pressure from passage *16a* can build up only in the diaphragm chamber *A* and act on the smallest diaphragm *60.* As the area of diaphragm *60* is 40 per cent of the main diaphragm, 40 per cent of the pressure in chamber *A* will be transmitted through the diaphragm stack to the main diaphragm. The application valve *32* and its piston *30,* therefore, will be held open by lever *43* until the brake cylinder pressure in chamber *F* and connected brake cylinders builds up to approximately 40 per cent of chamber *A* pressure, thus balancing the pressure on both faces of the main diaphragm, after which the springs *33* and *34* seat the appli-

cation piston *30* and valve *32*. This moves the upper end of lever *43* and piston *36* back to lap position in which the lower end of the lever holds the exhaust valve and its piston seated, retaining brake-cylinder pressure equivalent to 40 per cent of the straight-air-pipe pressure. This is maintained by the F. S. 1864 relay portion, as any leakage in brake-cylinder pressure will reduce chamber *F* pressure and cause the relay portion to operate and restore the balance of pressure on the main diaphragm. When train speeds exceed approximately 20 m.p.h., the speed governor deenergizes the L.S. magnet and spring *162a* seats the upper magnet valve *161a* and unseats lower magnet valve, permitting air from passage *16* to flow through passages *17* and *17a* to diaphragm chamber *K* where it builds up on diaphragm *64*. As this diaphragm is 60 per cent of the main diaphragm *38*, the brake cylinder pressure reproduced in cavity *F* by the relay portion is 60 per cent of that in chamber *K*. When train speed exceeds approximately 40 m.p.h. the speed governor energizes the M. S. magnet coil, pulling down its armature and stem which seats the upper magnet valve *161* and unseats the lower magnet valve, permitting air from passage *16* to flow through passages *18* and *18a* to diaphragm chamber N, where it builds up on diaphragm *68*. As this diaphragm area is 80 per cent of main diaphragm *38*, the pressure reproduced in connected brake cylinders and chamber *F* by the relay portion is 80 per cent of that in chamber *N*. When train speed exceeds approximately 65 m.p.h., the speed governor energizes the H. S. magnet coil, pulling down its armature and stem, which seats upper magnet valve *161b* and unseats lower magnet valve, permitting air from passage *16* to flow through passages *19* and *19a* to cavity *P* where it acts directly on main diaphragm *38*. The relay portion, therefore, reproduces brake-cylinder pressure equivalent to chamber *P* pressure. The operation of the diaphragm stack as controlled from the speed governor thus provides four braking ratios of 40, 60, 80 and 100 per cent which limit the maximum braking force.

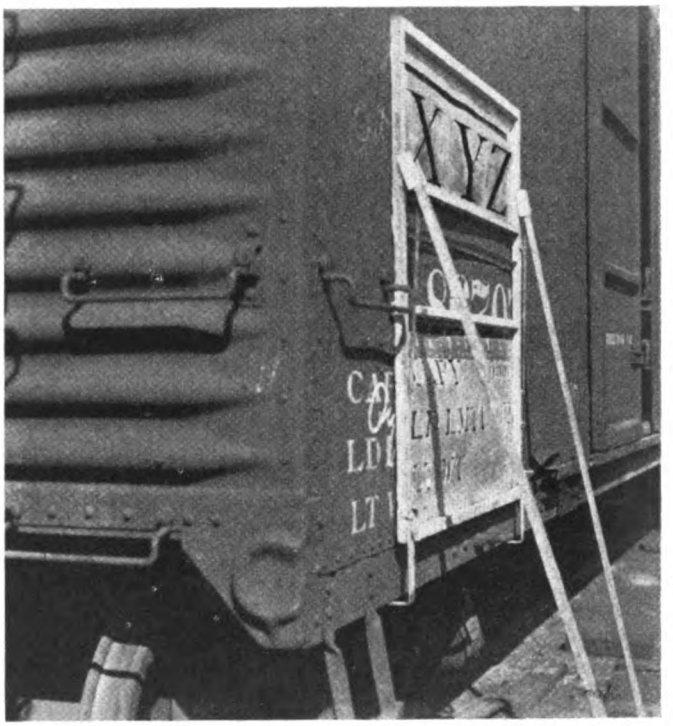
152—*Q.—Explain the operation as the train speed reduces.* A.—As train speed reduces, the speed governor functions to reduce the brake-cylinder pressure in proportion to the reduction in train speed. As the speed drops below approximately 65 m.p.h., the speed governor de-energizes the H. S. magnet and spring *162b* seats lower magnet valve *161b*, cutting off the supply to diaphragm chamber *P*, and unseats the upper magnet valve. The air in diaphragm chamber *P* then flows through passages *19a* and *19*, past upper magnet valve *161b*, choke *138* and passage *15* to inshot chamber *C*, and through passage *15a* to exhaust valve *93*. The air in chamber *C* deflects diaphragm *85* against the tension of spring *88*, moving piston *84* to unseat exhaust valve *93*, opening passage *15a* to exhaust *Ex*. This exhausts the diaphragm chamber *P* to 7 lb. inshot pressure, after which spring *88* returns piston *84*, permitting the exhaust valve *93* to be closed by spring *94*. This leaves the medium speed M. S. magnet energized, which establishes the 80 per cent braking ratio on diaphragm *68*. The relay portion then operates to make a corresponding release of brake-cylinder air. As speed drops below approximately 40 m.p.h. the speed governor de-energizes the M. S. magnet, which causes the release of pressure from diaphragm chamber *N* through choke *140* and the inshot portion exhaust, thus establishing the 60 per cent ratio on diaphragm *64*. As the speed falls below 20 m.p.h. the speed governor energizes the L. S. magnet which causes the release of pressure from diaphragm chamber *K* through choke *142* and inshot portion exhaust. The chokes *138*, *140* and *142* control the rate of exhaust.

Self-Locating Stencils

Stenciling of the cars after painting is considerably facilitated at one large outdoor paint track by the use of stencil frames which can be applied to cars and which, at the time of application, are so located that the painter can proceed with his work without the use of guide lines or measurements. Two types of frames are in general use; the first, frames which are designed to hang from the top rail of open-top cars, the other, frames used on box cars and located in position from the side sill.



Three section stencil required on a gondola car



The side sill limits vertical position of stenciling—Supporting poles hinged to the frames hold the stencil firmly in place

Both types of frames are of lightweight wooden construction. The stencil material is a heavyweight cardboard. Frames for open-top cars are suspended by clamps over the top rail and the letters can readily be spaced for horizontal position by eye; vertical positioning is taken care of in the frames themselves. On box cars clamps under the side sill establish the vertical limit of application.

IN THE BACK SHOP AND ENGINEHOUSE

Truck for Handling Mounted Driving Wheels

A four-wheel rail truck has been developed for handling mounted driving wheels at the Southern Pacific general shops, Los Angeles, Calif., as shown in the illustration. It is the practice at this shop to mount tires on driving-wheel centers about 300 ft. distant from the overhead traveling cranes of the erecting shop. Before using the truck shown, it was necessary to roll the wheels this distance by hand on a flush track, about eight men being required owing to the heavy unbalanced counterweights opposite the crank pins. This method of wheel handling also involved some degree of hazard owing to the difficulty, and, in fact, practical impossibility of stopping the wheels exactly when and where desired once they started to roll.

To save labor and promote increased safety, therefore, the special truck, shown in the illustration, was designed and equipped with roller-bearing flange wheels so that the truck with a pair of mounted driving wheels in place can be readily pushed by one man on any standard gage material track throughout the shop. Referring to the illustration, the construction of this truck will be readily understood. It consists of a welded steel frame, comprising two 80-lb. side rails connected at either end by 3-in. angles and having a 1-in. by 4-in. steel bar welded in place in the center to stiffen the construction.

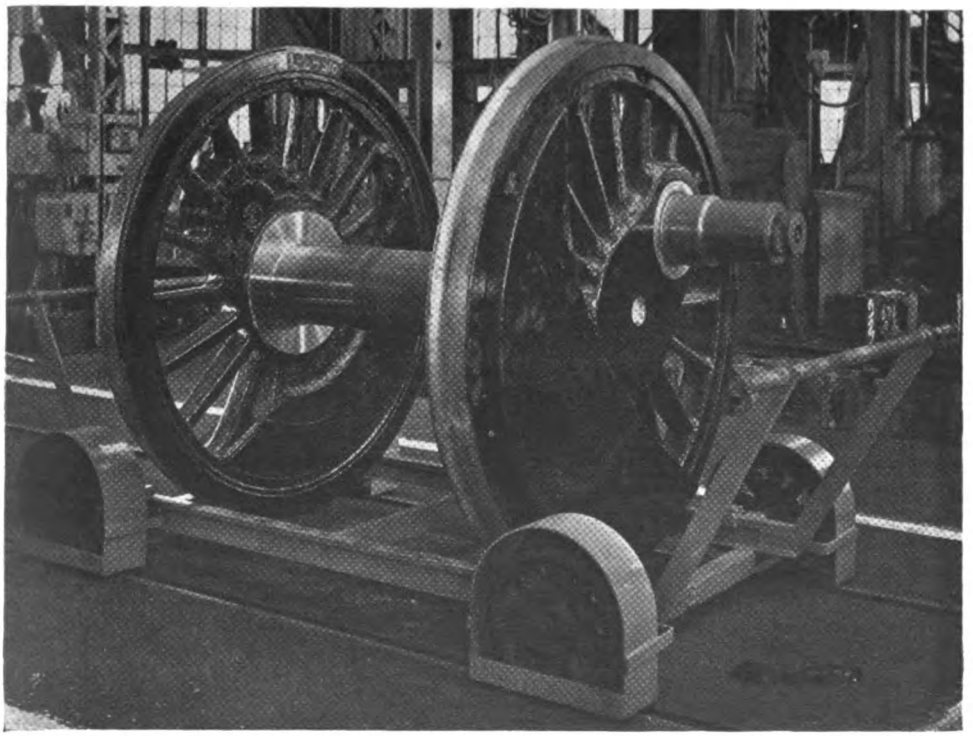
The end angles are welded to the rail bottoms and braced by short steel brackets, as shown at one corner. On the outside of the steel frame at each corner, a filler block and axle are welded to the rail and equipped with an 18-in. flanged cast-iron wheel, which revolves on 2½-in. roller bearings. The wheels of this truck are spaced 7 ft. on centers and the width set for operation on standard gage track. A sheet-metal guard, made of ¼-in. by 6-in. stock, is reinforced and neatly bracketed to the truck frame at each wheel position, as shown.

A 1½-in. pipe handle, 5 ft. 2 in. long, capped at each end, is supported in two handle bars made of ½-in. by 3-in. stock which is cut out and bent at the bottom so as to fit neatly between the head and base of the rail where it is welded securely in place. These convenient handles, one at either end of the truck permit readily pushing or pulling it in either direction.

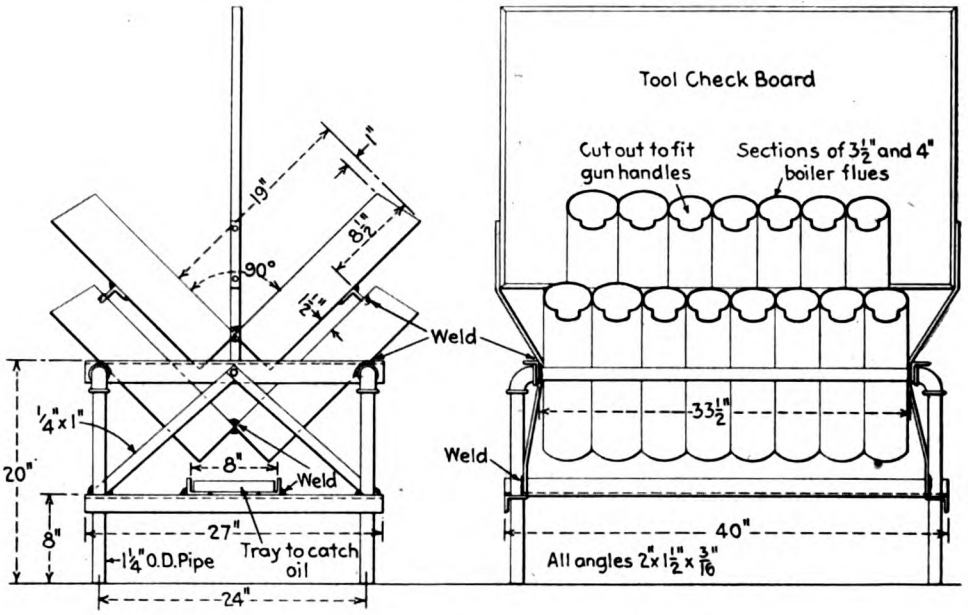
There is only one additional feature of this truck which might be mentioned, namely, the fact that, with the wheel-supporting rails spaced 4 ft. 1½ in. on centers, large driving wheels are carried satisfactorily, but smaller wheels would obviously drop lower into the truck frame and possibly have insufficient floor clearance. To meet this condition, four sliding steel shims 5 in. long by 2¾ in. wide on the top and 1½ in. thick are carried on the truck at all times and readily slipped in place under the driving wheel flanges when smaller wheels are being moved. The total length of this driving wheel handling truck over the handles is 11 ft.

Tool Room Rack For Holding Air Guns

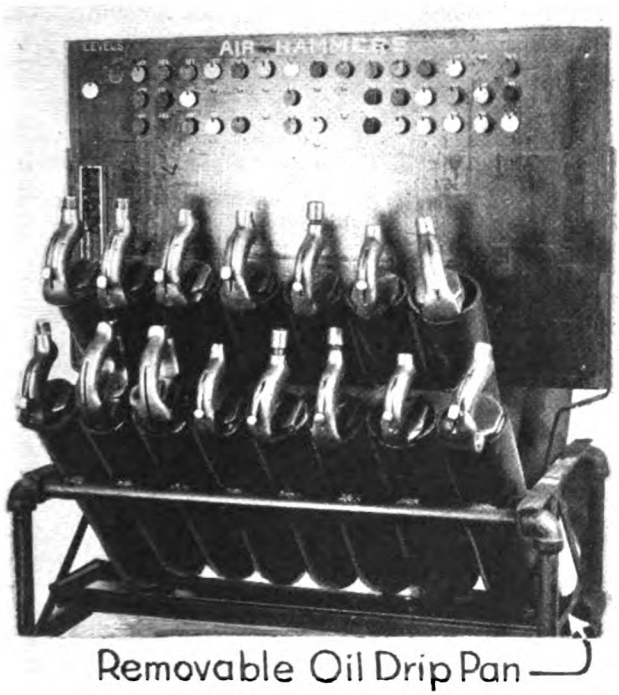
The accompanying drawing and photograph show a convenient rack in use in a tool room for holding air guns. By the use of this device all of the guns are in an even row with the throttles in just the right position for oiling. The notches cut in the pieces of old flue make a place for the handle of the air gun to go, and



Truck used in handling mounted driving wheels at the Los Angeles shops of the Southern Pacific



Sufficient details and dimensions are given in this drawing to facilitate construction



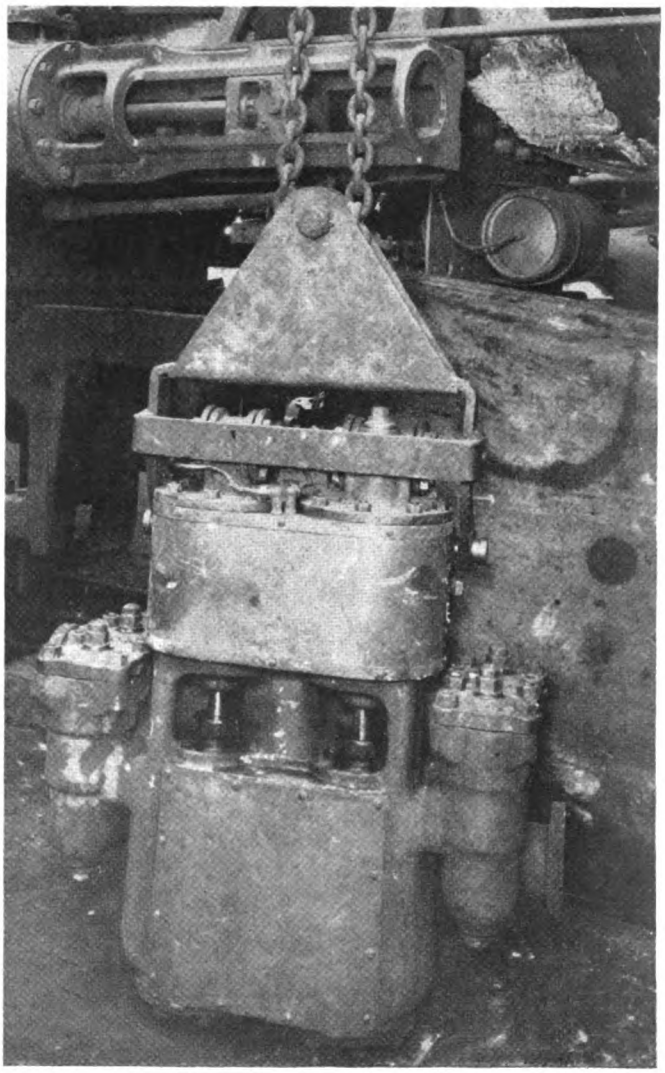
The air-gun rack in use—The checks for the tools are shown on the board

make certain that they will remain in a uniform position. The air guns drain into the pieces of old flue, and from there into the removable drip pan or tray to catch the oil—no oil from the guns reaches the floor.

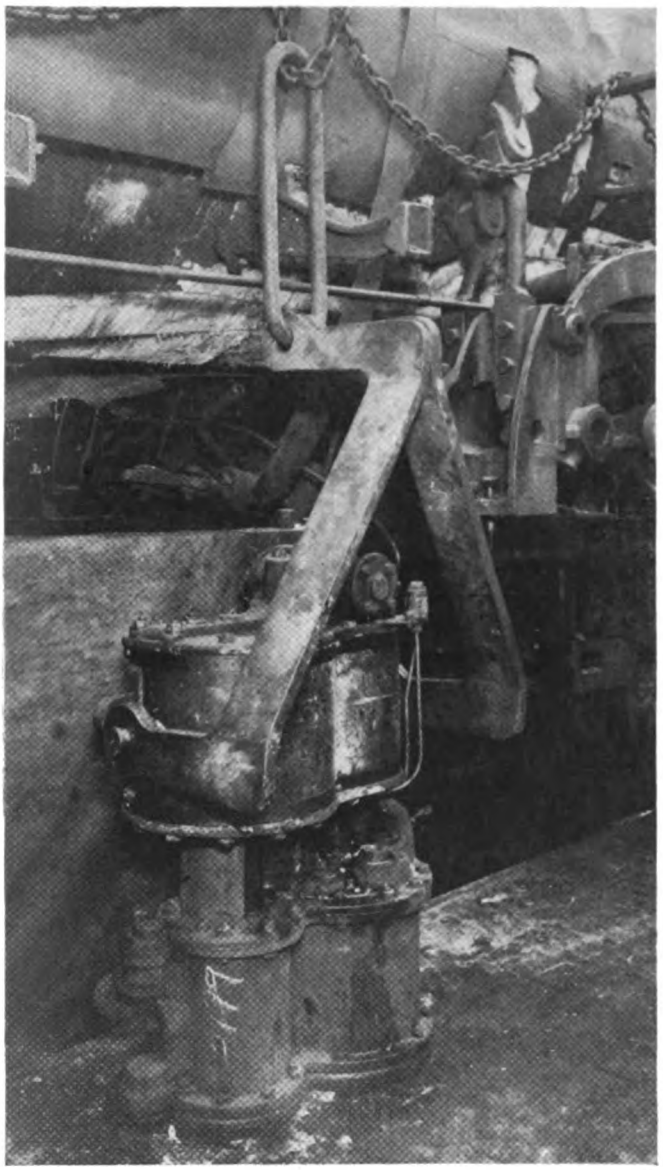
A board for holding the tool checks is right above the rack. Many steps are saved by keeping the tool and the check at the same location.

Two Lifting Devices From Topeka Shops

In the photographs are shown two special lifting harnesses for use in applying and removing and applying locomotive cross-compound air compressors and feedwater pumps. These were developed and are in use at the Topeka, Kan., shops of the Atchison, Topeka & Santa Fe. Both of these devices are secured to the equipment to be lifted by screwing trunion plugs into the intake- and exhaust-pipe hose. The air-compressor



A sling for handling feedwater pumps on and off the locomotive



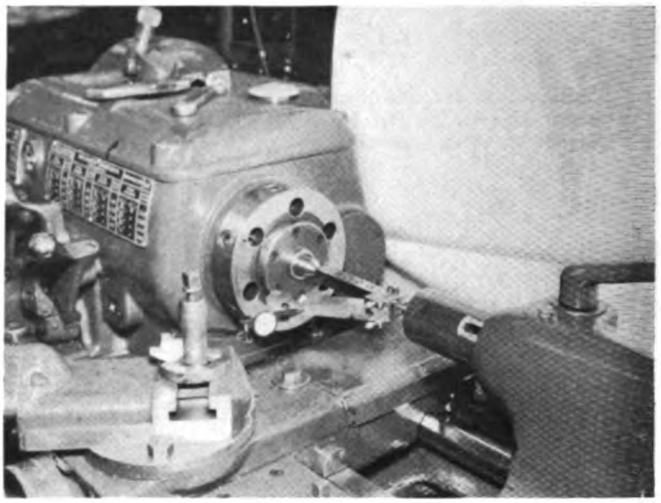
Harness for removing and installing locomotive air compressors which fits over the running board

harness is offset so that a compressor can be removed from the side of the boiler and replaced without removing the running board. It also protects the jacket and oil pipes from being damaged and insures safety in removing and applying the heavy compressors. By the use of this device one-half hour each is saved per operation. The harness for feedwater-heater pumps is, in effect, a part of a chain hoist. The horizontal brace rests against the cylinder heads of the pump, thus preventing it from swinging and holding it perpendicular. By the use of this device 24 min. are saved in the application or removal of the pump.

Tool for Angular Machining On A Lathe

A sine-bar arrangement for accurately setting a lathe compound rest at the desired angle without the use of graduations on the compound has been originated by G. F. Greene, a general foreman at General Electric's Schenectady Works. The tool was developed and is being used for the angular machining of high-precision bevel gears.

One leg of the bar is placed between lathe centers and the other leg is opened to the desired angle. The sine of the angle is obtained accurately by placing precision blocks between the fixed leg and the ground cylinder affixed to the movable leg. Two locking screws are provided to maintain the position after it is obtained. The compound rest is then set to the proper angle by the use of an indicator mounted to the tool post.



Method of setting the compound rest with the sine-bar attachment

Boring Chuck Retains Cylinder Roundness

*By C. T. Packer**

Difficulty is usually experienced in maintaining roundness in the finished bore as a result of holding methods in previous operations.

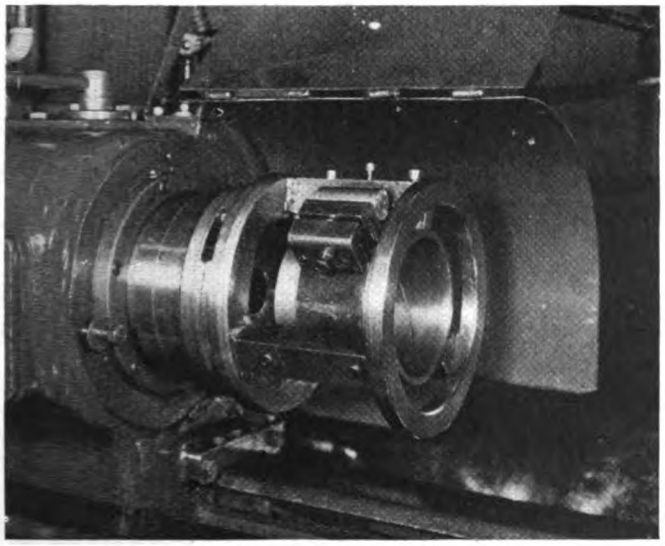
In a case where it is essential that the bore be round in a metal piece that is out of round on the outside, a chuck has been developed whereby three entering and support arms are bored the size of the finished diameter of the cylinder. Two of the supports are fixed, the other has release screws for easy loading and unloading.

In the face of the three supports is fitted a $\frac{1}{16}$ inch thick by 3 inches wide spring steel band having clamp lugs at each end. The groove for the band is $\frac{1}{32}$ inch deeper than the thickness which allows the band to lie in the clear for loading and unloading.

The cylinder is placed in the chuck. The band is clamped tightly around. Since the spring steel band is flexible it conforms to the contour of the cylinder but provides sufficient friction to drive the cut without distortion in the piece. After the clamp band has been tightened the clamp and cylinder unit is rotated until it stops against one of the supports which serves as a driver. The release screws are then tightened sufficient to hold the cylinder control but not enough to distort.

Satisfactory results are obtained from this type of chuck. For example, a cylinder 6 in. in diameter by 6 in. long to be turned outside and bored inside to 5.000 ± .001 in. The usual procedure is to start by using a three-jaw chuck. In most cases the chuck pressure nec-

* Westinghouse Electric and Manufacturing Company, Lima, Ohio.



This special chuck eliminates distortion when machining cylinders of a fixed diameter

essary to drive is sufficient to show a distortion of .005 or .006 in. on either bore or turn after removal from the chuck. By conventional methods of machining the distortion carries through to the finished product.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

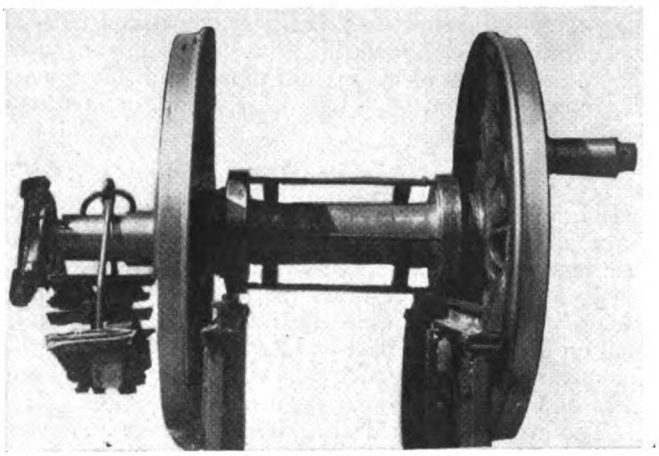
Setting Front Ends

Q.—We have trouble in setting front ends on a 40-ton Davenport, oil-burning locomotive. Can you give some information on front end setting and the drafting of the front end as to the firebox damper opening?—F. R. D.

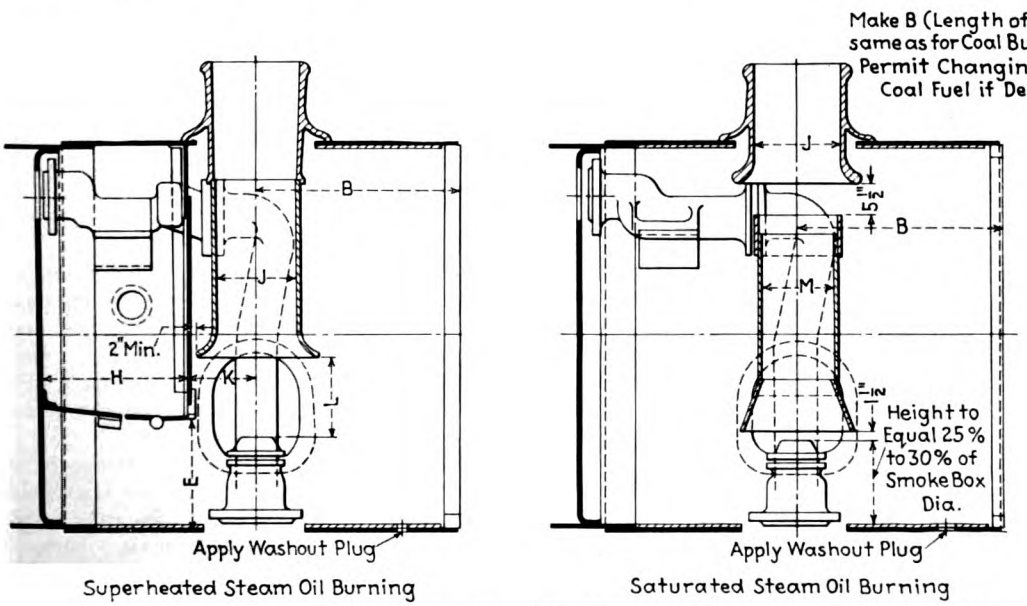
A.—A typical smoke box arrangement for an oil-burning locomotive is illustrated. Dimensions should be great enough to give a clear area through the netting of 125 per cent of the total gas area when using netting having a clear area of 50 per cent or more. Increase *B* to give 125 per cent when using a netting having less than 50 per cent clear area as in coal-burning locomotives. Dimension *E* should be large enough to give a minimum of 100 per cent gas area under the table plate for outside steam pipes. Locate the table plate to compensate for the loss of gas area if inside steam pipes are used. However, the table plate should not be higher than the bottom of the lower flues on superheated engines. Dimension *H* is governed by the type of header used.

Spreaders to Hold Cup Rings In Place

The accompanying illustration shows a spreader to hold cup rings in place while counterbalancing roller bearing type driving wheels. Experience indicates that if the bars of the spreader are tied together with strips welded in, it makes a solid job and there is no tendency for the assembly to collapse as the wheels roll on the balancing rails. Originally, four straight pieces of pipe were used.



The spreaders in use on the bearings on mounted wheels



	Standard Cast Iron Stack Extention		
M	L	K	J Dia.
9"	13"	11"	11"
10"	13"	12"	12"
11"	14"	12"	13"
12"	14"	13"	14"
13"	15"	13"	15"
14"	15"	14"	16"
15"	16"	14"	17"
16"	16"	15"	18"
17"	17"	15"	19"
18"	17"	16"	20"
	18"	16"	21"
	18"	17"	22"
	19"	17"	23"
	19"	18"	24"

Smoke box arrangements must provide sufficient clear area for proper drafting

Traction Motors and Generators*

By J. W. Teker†

Some suggestions on the type of supervision required to prevent unnecessary shopping of Electric and Diesel-electric locomotives

SUPERVISORS confronted with the loss of expert workmen who carry routine practices in their heads or with the influx of new help must be especially on the alert for neglect of preventive maintenance methods and must again get close to the job to see that specific standing instructions are available and that schedules and records are not neglected.

The neglect of some simple detail by one man may start a chain of events to culminate in a serious breakdown and require an entire crew of men with shop facilities already sorely taxed to make corrections. The lack of only one-half minute's attention to cleaning a terminal may cause the contact surfaces to overheat and burn off when most heavily loaded. A resulting motor failure may cause a train to be brought in late with the remaining motors overheated. This is sabotage, unintentional but effective.

Lubrication

Lubrication of electrical traction equipment falls into three divisions, namely, sleeve bearings, anti-friction bearings, and gearing. The basic purpose of lubrication in all of these is to separate the moving elements from each other by a film of oil which must support the entire load on these moving parts. Interruption of this oil film for any reason immediately allows contact between surfaces and destructive wear begins.

[The original paper deals extensively with lubrication of sleeve and roller bearings but, due to the railroad man's familiarity with these requirements, this part of the paper is not included.—EDITOR'S NOTE.]

There is a common misconception that gear teeth are shaped so that they may roll on each other. Actually, the tooth surfaces slide on each other, the roll being confined to a very small portion of the profile, and the tremendous forces of moving a train are transmitted to the drivers through this sliding contact between gear teeth. It is a vital necessity to separate this contact by a lubricating film; otherwise, destructive wear is certain.

Gear lubricants in common use depend upon their adhesiveness to keep the teeth covered with a protective load-carrying film. This stickiness is essential as centrifugal force tends to throw the lubricant off the teeth. The lubricant is renewed as it dips into the quantity contained at a proper level in the bottom of the gear case. The properties of the gear compound must be such as to flow readily into the path of the rotating gear and yet be sticky enough to adhere to the tooth surface, and have load-carrying ability. These properties are affected by temperature. Most compounds do not have sufficient range to cover the extremes in temperature encountered from summer to winter. Careful selection of proper grades for winter and summer operation must be made where wide temperature variations are encountered. The heavy summer grade will set up solid at low temperature and the gear will channel through it without being wetted. A winter grade of thin lubricant during the heat of summer operation will fail to stick to the teeth at speed, or at heavy load is too thin to separate the gear teeth.

A few hours of heavy-load running without adequate lubricant may lead to irreparable damage. Gearing will overheat and damage the heat treatment of the steel. Excess pinion temperature by conduction through the armature shaft can overheat the roller bearing. The unequal expansion of inner and outer races, absorbing the internal bearing clearance until loaded beyond limits by internal radial stress, can cause complete destruction of the bearing, frame heads and even destruction of the armature core when it drops on the field pole pieces at high speed, all because of faulty gear lubrication.

A necessary adjunct to gear lubrication is the gear case or gear cover. Its two functions are to keep the lubricant in and to keep foreign material out. The tongue and groove joint between upper and lower halves, the baffles and seals around axle and pinion fit originally installed by the manufacturer are seldom maintained. This is so discouraging and futile that in some designs they are completely omitted.

Contamination of gear lubricant with material picked up from the road bed makes an excellent lapping compound with no chance for grit to settle out in the thick viscous lubricant and the very object of lubrication, to prevent wear, is defeated.

Every time a gear case is dropped for wheel change or motor change-out it is an opportunity to renew seals, check gear teeth for signs of lubrication failure and take necessary preventive measures.

Cog Wheels or Gearing?

Fortunately, gearing has considerable power of recovering and after many abuses continues to transmit power even after its fundamental tooth profile has been destroyed and rendered into mere cog wheels. Gear teeth seldom fail in service but continue to operate until attention is arrested by their appalling appearance and the gears are changed out from sheer fright.

Too much attention is centered on the strength remaining in worn gear teeth from a breakage standpoint with a total disregard for the carefully designed shape of the tooth profile. There is a vast difference between cog wheels and gearing. The precise original shape of the involute tooth, while not necessarily the only pos-

* Abstract of a paper presented under the title "Keep Them Rolling," before the annual meeting of the American Institute of Electrical Engineers held in New York, N. Y., January 26, 1943.

† Engineer, General Electric Company, Erie, Pa.

sible shape, is to maintain uniform angular velocity between gear and pinion. Deviation from a proper shape for uniform angular motion for any reason makes smooth uniform rotation between pinion and gear impossible and jerky power transmission begins, attended by severe instantaneous stresses and torsional vibration.

When gear, pinion and axle linings remain mated over a long period the wear is gradually adjusted between the members without causing serious deviation from normal operation. This may continue until bearing lining wear effects a gradual increase in gear center distance and the gearing may also wear to a depth sufficient to produce a step in each tooth profile.

Now, if the gear center distance is restored by installing new linings it is evident that the tooth tip will be caused alternately to ride up and off the step formerly worn into each tooth and there is interference. The same occurs when a worn gear or pinion is mated with a new one. Tremendous stresses are set up at the interference point until the teeth are battered into agreement. While this is going on the armature shaft, bearings and the armature winding are enduring the punishment of bending and vibratory torsional stresses.

The interdependence between apparently unrelated parts is startling; lubrication failure in gearing or axle linings may be followed by broken armature shaft or a grounded armature winding resulting from vibratory stresses beyond the limits of the construction during the breaking in period of unrelated gearing.

As soon as operators recognize the characteristics of true gearing they will give immediate consideration to such practice as keeping gear and pinion mated even though the motors themselves are changed around. When a motor is changed out the pinion is removed and installed on the in-going motor, thereby keeping the same pinion and gear running together. In order to retain existing gear center distance, the linings should also be removed and installed on the ingoing motor.

When worn gearing must be matched with new or where interference in tooth profile may result for any reason, consideration should be given to having the worn gearing replaced immediately with the same dispatch that worn wheels are ruled off the road. Fundamentally the question resolves itself into a choice between the additional miles to be obtained from damaged gearing and the punishment being sustained by a costly traction motor transmitting its power through cog wheels no longer capable of their original gearing function. Where armature failures are frequent this aspect of the problem is worthy of serious study in the interests of economy and availability.

Present day facilities for pulling pinions, easily controlled means for heating pinions, and the measurement of correct advance simplify the pinion mounting operation to such extent that the practice of keeping pinions and gears mated is simple, quick and attractive in view of the benefit to be gained.

Insulation

There is much that can be done to forestall trouble in motors and generators while they are mounted in the locomotive. A regular check of insulation resistance with a Megger when a locomotive comes in from a run is a simple and quick operation, yet it may detect a defect which might result in a ground failure on the very next run.

Make high potential tests sparingly and carefully, preceding them with a Megger insulation check; otherwise a puncture or creepage failure may result from the test which could have been avoided by first finding the weak spot with the Megger and cleaning, drying or repairing locally as necessary.

Brushes and Brush Rigging

Care must be exercised when installing new brushes to prevent the snapping down of spring levers with such force as to chip or shatter the brush. Carelessness in this respect may ruin a brush before it has a chance to render useful service.

Install a new brush in such a manner that the pigtail is placed on the far side of the carbonway away from the side on which the pigtail terminal screw is located. This permits an easy loop to be made over the brush, with little chance of its being bent over the edge of the carbonway and thus hang a brush up so as to prevent free vertical movement. Where pigtails bear against the edge of the carbonways or spring levers, there is a rapid wear of the individual strands by prolonged vibration until the pigtail is cut through and left free to wave about, with possibilities for motor flashover or ground.

Dusty operating conditions allow granules of dirt to collect between brush and brushholder carbonway which results in causing the brush to stick so that the freedom of vertical motion is restricted and the brush does not ride the commutator properly. This contributes to sparking, flashovers, rapid commutator and brush wear. These granules leave unmistakable evidence in the side walls of the brush in the form of lightning shaped, threadlike grooves, radiating from the top to the bottom of the brush where it makes contact with the carbonway. The correction is to find where and how grit enters the equipment and then take preventive measures if possible, and to frequently slide the brushes in the holders and blow the clearance space clear of dirt.

The screw which secures the spring lever shunt to brushholder body is worthy of careful inspection, being hard to get at and commonly overlooked, yet capable of serious damage to the motor. When this screw works loose and causes poor contact between the spring lever shunt and the brushholder body, the current normally carried by the shunt is caused to flow through the brushholder spring instead. Under heavy load, this current may be of sufficient magnitude to anneal the spring and cause loss of spring tension on the brush. The failure of the brush to maintain contact with the commutator causes arcing and overloading of other brushes, which ultimately leads to flashovers or complete destruction of the brushholder by melting off from sustained arcing. The possibility for this screw to work loose completely and fall onto the commutator where it jams against a brushholder and causes a deep groove to be cut into the commutator, short-circuiting all segments, is more serious, making it necessary to cut the motor out of service and remove it for major repairs.

Commutators Reveal History of Locomotive Handling

Observation of commutator surface appearance is a quick means for sizing up the general health of the equipment. Poor appearance is evidence to the practiced eye that trouble exists, but it is not always so simple to quickly ascertain the true cause. Fortunately commutators are capable of long suffering and like gearing they seldom fail suddenly, but give ample warning of impending trouble in time to hunt down the cause. Poor commutator condition does not always imply that the cause is within the machine, but may also be traceable to external faults or conditions, the effects of which reveal themselves on the commutator and leave their record burned into its surface.

For instance, it is not uncommon for enginemen trained in steam practice to completely stall the locomotive intentionally or forgetfully for unduly long periods with partial power on the motors. This is harmless in steam and even good practice under some circumstances, but is capable of extreme damage to the electric drive. This may occur when a train is braked to a stop with power on to keep the train slack stretched out for a smooth start and then failing to shut off power for the duration of the stop. Again, a train may be held on an inclined spur with power on while the train crew look for blocks to hold a car so that it can be uncoupled from the train.

Fundamentally, any operation which brings a motor to standstill while heavy current continues to flow causes intense local heating at the point of contact between brushes and commutator, especially if brushes are tipped to contact along one edge of their face by a slight backward movement of the armature just before the full stop was made. These local contact spots when unduly prolonged may reach red or white heat and anneal the copper commutator segment involved, and also burn the shellac binder in the mica segment or mica commutator cone.

This local damage, varying from one overheated bar to as many as four groups of bars spaced 90 deg. apart in severe cases, does not immediately incapacitate a motor. The overheated segment now annealed, or the burned mica, lacks the necessary strength to keep its position under the action of centrifugal force at high operating speed and creeps above the general commutator bar surface to become a high bar with the attendant marking and burning of the surface, or the shattering of brushes and frequent flashovers.

Such bars may be found near or in the telltale burned spots at equally spaced intervals 90 or 180 deg. apart and it may be evident by the discoloration at their ends, marking them from the others, or they may require searching for with a scleroscope or some equivalent means.

While it is possible to keep such motors in operation by frequent cleaning or stoning of the commutator surface, ultimately a major repair is necessary to remove the annealed bars, patch or renew mica cones and reassemble with new hard bars.

A closer regular pattern of burned bars, especially in generators, traceable to external causes, may be brought about by the engineman failing to make a backward transfer to the series connection upon encountering a grade with a heavy train such that the speed is dragged down and the current of motors in parallel connection exceeds the commutation ability of the generator, and when prolonged, burns the commutator and overheats the armature winding.

A similar commutator condition is also possible by the accumulative flashing at brushes over a period of time, brought about by a delayed transition from series to parallel motor connections, in which case the control equipment requires attention and adjustment.

Sluggish reverser operation during extremely cold weather when air compressor oil condensate may reach reverser air cylinders can cause severe shock to the entire transmission apparatus by allowing Diesel engine speed to rise well above idling speed before the circuit is closed through the reverser contacts.

Sluggish air brakes may lead to emergency or convenient plugging of motors into reverse while the train is still moving ahead to effect a quick stop. The magnitude of the commutation task under such conditions is bound to blast the commutator surface, leaving a wake of splattered copper beads and craters in the surface to upset the smooth riding of the brushes.

Resurfacing Commutators During Layover Time

There are occasions, whatever may be the cause, when locomotive commutators require resurfacing in order to continue operation. Much of this can be quickly and easily accomplished in the locomotive unless the condition is such as to justify removal to a repair shop.

Such resurfacing is commonly done with a commutator resurfacing stone held by hand or in a tool and applied to the commutator, rotating at sufficient speed to do a good grinding job. When the stone is hand held it should be large enough to permit a maximum arc of contact with the surface. This will allow it to ride over the low spots, rather than down into these hollows, and thus cut the high spots down first and thereby tend to produce a cylindrical surface. Remove a brushholder when it prevents the use of an ample stone size.

When irregularities are beyond correction with a hand stone, a rigid tool or fixture can be adapted to the special needs of the machine to hold the cutting stone steady or to mount a conventional carboloy-tipped lathe cutting tool for the rough cut and then finish with a stone.

The brushes should be removed during the resurfacing operation to prevent their rapid wear and dusting. Clean the oily and greasy surfaces before proceeding with the resurfacing so as to prevent adherence of the grinding dust and to permit easy cleaning of the equipment after finishing with the operation. When possible, erect cardboard shields so as to baffle the interior of the machine against entrance of this dust.

Install two old brushes to supply power for driving the motor armature during the stoning. The axle, mounting the motor, is then by suitable means jacked up so that the armature and wheels are free to rotate. The remaining wheels of the locomotive must be blocked or have the brakes set so as to safely hold the locomotive stationary while the one axle is raised and left free to rotate.

Driving power may be simply obtained from the locomotive's own Diesel power plant by going into the first operating position which, in most cases, will provide sufficient speed to do an excellent resurfacing job. The current required to rotate the armature is so low that no damage will result to the stationary motors through which this same current is flowing. An alternative, if preferred, is to obtain power from a welding set or some other suitable direct current power source.

In the case of a generator a similar resurfacing operation is possible in the locomotive by first starting and warming up the Diesel engine so as to permit a quick easy start later, then shut down and remove most of the brushes from the commutator, leaving only a few easy-to-reach brushes in about three-quarters of the readily accessible brushholders of each polarity.

The engine is again started and these remaining brushes are removed and the resurfacing operation is ready to proceed without affecting the brushes, which, as in the case of the motors, would be excessively worn during a prolonged resurfacing operation. Block out all contactors to insure no-voltage during the process.

The "Air Cure"

Thorough cleaning of the apparatus is essential and special attention must be given to the undercut spaces between segments to see that all dragged over copper, accumulated dirt and carbon are removed.

A powerful tool for the detection and cleaning of these spaces is a procedure referred to as "air curing."

A strong jet of dry compressed air is blown against the commutator, held close to and directed across the surface so that the impact will dislodge material in the grooves while the commutator is rotated at gradually increasing speed and maximum no load voltage.

In the case of a generator, this is done with motor contactors blocked out to open the load circuit and field contactors closed in to obtain maximum excitation at full engine speed.

In the case of a motor, this is done at available voltage within the speed limitation of the motor, which for practical purposes is sufficient. It is possible, when necessary, to obtain full motor voltage at full speed by resorting to separately controlled motor field excitation circuit in order to keep within the maximum motor speed limitation.

When sparking or rings of fire appear under the impact of the air jet, the speed and voltage should be held until it clears up. It may, in stubborn cases, be necessary to shut down and dig the troublesome spots clean before proceeding.

It is well to apply this air cure process to motors or generators reported to repeatedly flash over for unknown and unfound causes as a means to locate weak spots in commutator segment insulation.

The operator should protect himself during resurfacing and air cure processing against flying particles, dust and flashover by wearing goggles, respirator and suitable gloves in keeping with approved safety practice.

Cables, Cleats and Connections

Motor cables and cleats should be examined each trip as the swing of cables between locomotive and motor concentrate stress at the cable cleats which becomes the point of wear and cracks in insulation. Such defects, if not discovered and repaired, will lead to motor or power plant failure, especially during wet weather when creepage over and through these broken surfaces will result in a ground which may be serious enough to burn off a motor cable.

Motors are at times removed in emergencies and during the rush the contact surfaces of the terminals may be overlooked so as to make contact through a dirty surface which, later in operation, will cause overheating and the melting of the soldered connections between terminal and motor cable, which may become serious enough to burn the connection off completely, open circuit or ground the equipment.

Loose Bands Can Lose Armatures

The loss of a power plant may overload the remaining equipment in order to bring the train in. Operators may take pride in bringing a train in under such conditions and justly so, but the maintenance man must be on the alert to see what the consequences of such operation are to the remaining equipment. Enough damage may result when heavily overloaded to cause loosening of bands, shrinking of insulation, and slot wedges which permit the vibration of armature windings. The mechanical vibration of conductors ultimately wears insulation thin so that final failure occurs by electrical breakdown when least expected and under comparatively easy operating conditions. Such failures result from former abuse.

Similar damage from overheating is caused by operation without traction motor blowers when necessary for adequate ventilation of the motors, or insufficient air when fan belts slip.

Overloaded motors should be changed out as soon as possible without waiting for the completion of their standard reconditioning mileage. Remove the armature immediately to make a careful inspection of bands, wedges and insulation.

Extreme temperature gradient will exist within the motor during overload operation. In parallel ventilated traction motors the armature temperature may be expected to increase from the commutator end to the pinion end. The end winding will be hottest because it is insulated and covered over by a band and is ventilated by the hottest air, while the commutator end of the winding can conduct its heat to the exposed surface of the commutator. Where overloads persist as on a grade or are repetitive, such as frequent starting of a train with one of two power plants shut down, pinion end temperature may easily reach a value sufficient to melt the solder on the pinion end band and yet leave the commutator end band and commutator rise soldering intact.

Such damage may easily escape detection by casual observation through the commutator end inspection opening. Hence the importance of disassembling to be able to view, tap and feel the pinion end band for signs of loosening.

A band unsoldered, especially at speed, will cause its relaxation and this along with shrinkage of varnish and insulation at these extreme temperatures permits vibratory movement of the windings. Prolonged operation with such mechanical motion wears through the insulation and culminates in ultimate electrical failure.

This mechanical condition detected in time has good prospects of successful repair if the band and band insulation are removed and the armature winding is thoroughly treated in good insulation varnish and again rebound. This treatment is comparatively quick and inexpensive as compared with a serious failure due to neglect, necessitating a complete rewind in order to restore it to service. The prospect of successful operation, after delayed treatment, is difficult to predict. Slot wedges should also be checked and renewed when damaged as these may allow the winding to burst out of the slots even though the end bands are renewed.

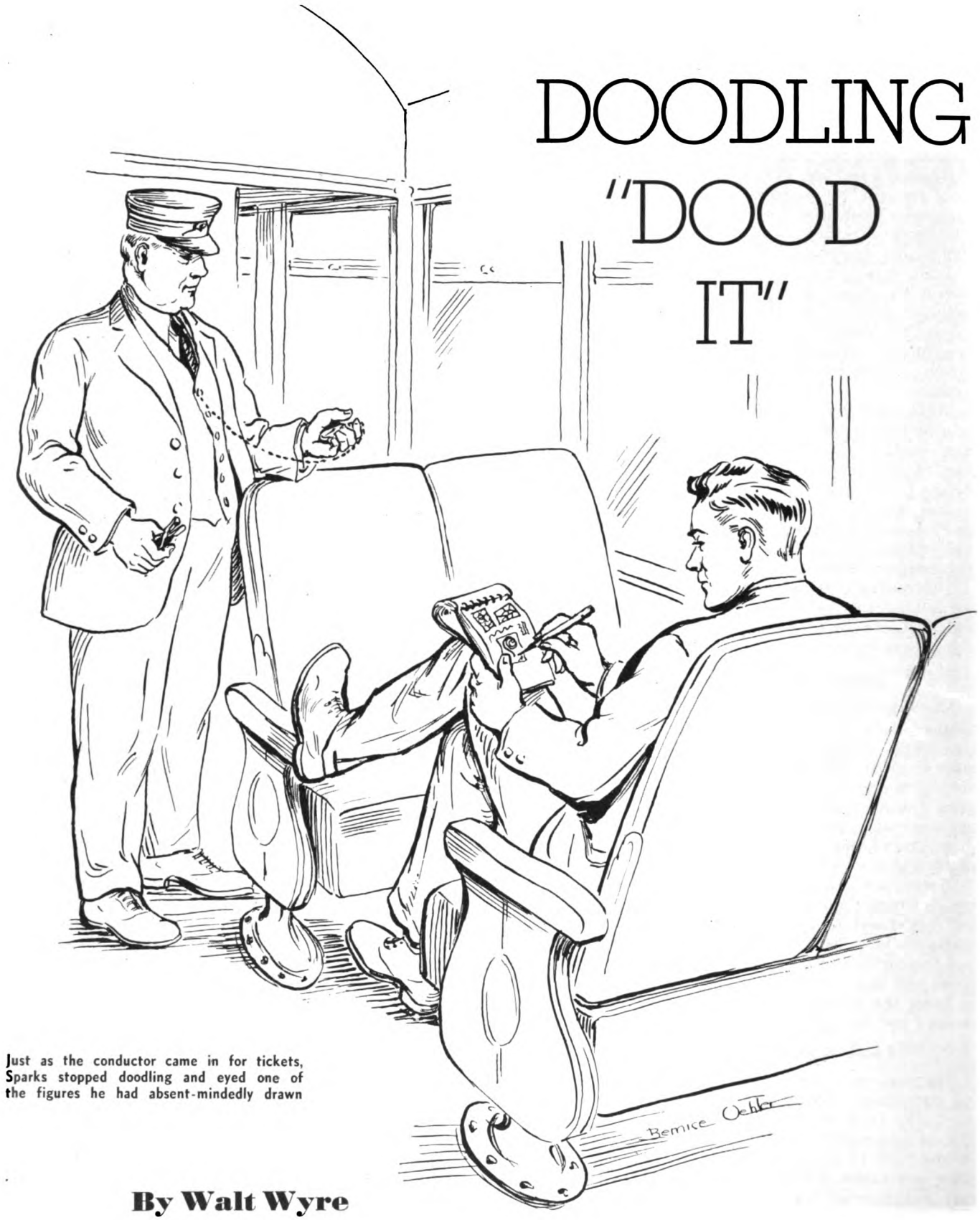
This is a good time to emphasize the importance of proper anchoring of the ends of the banding wire. The anchor should be such that it will hold even after the solder is thrown off. It will permit operation so as to bring the train in, which otherwise may have resulted in losing a band and bursting the winding.

There are various designs for anchoring of the band, the basis of which is to have the start and finish of the band caught in the same clip extending through from one side of the band to the other. The ends of the band are looped back and then secured by pulling the end of the clip back under the turns adjacent to the end. A band so secured may slip and relax slightly when unsoldered but will not let go.

When overloads are sustained so that all parts of the armature tend to reach uniformly high temperature, all bands will unsolder as well as the commutator riser connections and this is easily detected by observation through the commutator end inspection opening. Operators are quick to remove such obviously damaged motors, but unfortunately, where outright failure has not occurred, the tendency is to assume that all is in order and continue operation while under the surface of the relaxed armature band the vibrating winding is eating into the vitals of the armature.

Failures do not happen—they are caused, and deserve close engineering inspection and analysis with unprejudiced zeal to search the events leading up to the failure before corrective measures in design, operation or maintenance can be intelligently and effectively applied.

DOODLING "DOOD IT"



Just as the conductor came in for tickets, Sparks stopped doodling and eyed one of the figures he had absent-mindedly drawn

By Walt Wyre

"THE division engineer wants to know when you can go to Sanford and install the wiring for the automatic equipment on the boiler," H. H. Carter, master mechanic of the Plains division of the S. P. & W., said to Ned Sparks one morning a few days before Christmas.

"Well," the electrician hesitated a moment, "I've got quite a bit of work here that should be done. They're in a rush to get the wiring done for the main-line fuel-oil cranes. The new well they're putting in will be ready for the pump motor next week and everybody is hollering about getting push-button stations for the cold-water pump in the washout plant."

"Have you got the material for all of those jobs?" the master mechanic asked.

"Everything except for the push-button stations," Sparks replied.

"Well, I guess you had better stay and finish some of the work here in Plainville," Carter said. "Those main-

line oil cranes will save considerable time running engines through and if we don't get that new well going pretty soon, water will have to be rationed. The city has already notified us that they will not be in position to sell us water much longer. I'll tell the division engineer it'll be after the first of the year before you can do the job at Sanford."

The master mechanic went back to his office. The electrician went to the storeroom where he had started when the master mechanic had stopped him.

Dick Wheeler, the car foreman, was in the storeroom when Sparks got there. "Say, when are you going to get a push button at the car department for the water-pump motor?" Wheeler asked.

Sparks felt in his pockets as though looking for something and shook his head. "Haven't got it," he said seriously.

"Haven't got what?" Wheeler inquired.

"Haven't got 3,000 feet of weatherproof wire, eight three-wire racks, and a few other odds and ends needed to put a push button at the car department for the water pump."

The car foreman didn't seem to appreciate Sparks' attempt at humor. "I've been trying to get a push button for that pump over three months. Every time we wash out a car I've got to send a man to start the pump, then send him back to stop it, or else leave the pump running. I haven't got enough men to do the work as it is without having one putting in half his time walking back and forth to start and stop that pump."

"That's right, I guess," Sparks agreed. "And the roundhouse foreman doesn't like to have to send some one when he fills a tank in the house, but I can't do the job without material and it'll take somebody with more power than I've got to get it."

"Well, I'm going to talk to the master mechanic about it," Wheeler said.

"Ask him to get a couple of pounds of bacon and some coffee," Sparks said, but not loud enough for the car foreman to hear. Wheeler was usually ready to joke, but he didn't seem to be in exactly the mood at the moment.

"How about a few half-inch conduit straps?" Sparks asked the storeroom clerk who had come up while Sparks and the car foreman were talking.

"How many?" the clerk asked.

"Two dozen; how many do you have?" Sparks replied.

"None," the clerk answered.

"Anyway, you have a good alibi that'll last for the duration," Sparks said. "But I'm not disappointed, I already had a sheet of second-hand galvanized car roofing spotted to make some straps before I came to the storeroom."

SPARKS and his helper would have finished the job of wiring the main line oil cranes in four or five days if the work had not been interrupted by various other emergency jobs that became more frequent as the approach of Christmas brought the crest of the flood of business that already almost had the S. P. & W. submerged.

The wiring was finished December 22. The day water-service men started installing the pump in the new well. Sparks had it all figured out—he and his helper would run the three-span line in the next two days, then he and his hireless cooker would do a little celebrating Christmas Eve, then set the alarm clock as usual so he could have the pleasure of telling it to go to hell next morning, then sleep until noon.

That was the afternoon the portable crane hook caught on the conduit that carried the welder circuit in the roundhouse. A new man was operating the crane, he was backing up and watching to see that he didn't hit anything with the crane. He didn't notice that the boom was too high to clear the conduit. How he managed to catch the conduit will always remain a mystery, but he did. Then instead of stopping when the crane stalled he shoved the lever down and gave it all the power it had.

Sparks went to the roundhouse office and phoned his wife that his part of the celebration would take place in the roundhouse. While the electrician was getting a couple of wrong numbers, the roundhouse foreman came in and handed Sparks the last straw, except it wasn't a straw but a piece of yellow paper.

Sparks finished reading the typed message while waiting for his wife to answer the phone. She placed the receiver to her ear just in time to hear Sparks say "I'll be damned."

"You must have the wrong number," Mrs. Sparks said.

"Oh, hello, no, I wasn't talking to you. I'll be a little late getting home. . . . No, I wasn't swearing at you, I was swearing at this message. I've got to work tomorrow, got to get the motor on a pump connected. Sorry, I can't go with you. . . . No, you needn't wait for me, it'll probably be ten or eleven o'clock before I get home—'bye!" Sparks hung up the receiver and went back to the roundhouse.

It would have been quicker to run new conduit where the portable crane had broken the line, but there wasn't any new available. The 1¼-in. conduit had broken off at a coupling but did a lot of bending before it broke. The wires carrying current at 440 volts were shorted and burned through before the fuses went out which made it necessary to pull in new wire.

However, Sparks had been slightly pessimistic about the time it would take to finish. He had it done by 9:30 which was still too late to eat, clean up, change clothes and go places and work next day.

CHRISTMAS day was neither white, bright, nor merry for Ned Sparks and his helper. A cold raw wind from the northwest reminded the electrician of a perfectly good sheepskin lined coat that his wife had given during a "bundles-for-Britain" drive. There weren't any more when he tried to buy another.

Despite the cold Sparks and his helper made fair progress on the job. They didn't finish, but all they lacked was soldering and taping connections and connecting the controller wiring.

Next morning while they were finishing the wiring to the pump motor the master mechanic came out.

"How are you getting along?" Carter asked.

"Oh, fairly well, I guess," Sparks told him. "We should have it ready to try out in about an hour."

"That's fine," the master mechanic said.

Sparks knew by experience that when the master mechanic used that "well done" tone of voice he had something else up his sleeve or to be more exact, in his mind. This time was no exception.

"Can't you manage to dig up enough material to install a push button at the car department for the cold-water pump motor?" Carter asked.

"Well," Sparks spoke dubiously, "I doubt it. Material has been ordered but I don't know when we'll get it."

"It sure is needed; takes a lot of time for a man to walk all the way from the car department to start

the pump then walk back to the washout plant to stop it. See if you can't figure out something on it." Carter stood around a few minutes looking at the pump and asking an occasional question, then went to the roundhouse. "Let me know what you figure out on the push button," he said as he left.

Sparks finished connecting the well-pump motor, started the motor and let it run just enough to see if rotation was in the right direction. It was, for a wonder; then he and his helper gathered up his tools and carried them to the electric shop. He then started, without hope of success, hunting wire to run a control line for a push-button station at the car department. He spent the time until noon searching for material. The net result was almost five or six hundred feet of odds and ends of wire of assorted kinds and lengths. In one corner of the treating plant where material left from jobs was sometimes thrown Sparks found a mercury-tube pressure switch. He looked at it a moment, noticed that the range was from 10 to 100 pounds, then laid it down.

AFTER lunch Sparks went to the washout plant, stood around several minutes looking at everything in general and nothing in particular. Buzzing around in the back of his head like a bumble bee in a jug was an idea that the mercury pressure switch might somehow be used to start the motor when a valve was opened at the car department and stop it when the valve was closed.

He figured out a way to stop it if the pump was running. When all valves were closed, increased pressure would operate the pressure switch and stop the motor but that was only half the problem—besides getting the cart before the horse. The pump had to be started before there would be any need of stopping it. Still, that was something. It would save half the trips from the car department to the pump.

Sparks went to the treating plant and got the pressure switch and carried it to the electric shop. He was sitting on the work bench looking at the pressure switch when the master mechanic came in.

"Well, how did you make out finding material?" Carter asked.

"Not so good," Sparks replied, then told him about the idea for stopping the motor.

"What's going to happen if somebody goes and starts the pump without first opening a valve?" the master mechanic wanted to know.

"The pressure switch would stop the motor," Sparks admitted. "I never thought of that," he added.

"Well, maybe you're on the right track, anyway," the master mechanic said. "Keep working on it."

"I'm just a plain garden variety of damn fool!" Sparks told himself when Carter had left. "Why didn't I just tell him that I couldn't get the job done until I got the material and let it go at that!"

Except for a little time on a few small jobs, Sparks spent the afternoon until quitting time figuring on the problem without success. Several times he decided to give up and quit thinking about it, but his mind wouldn't let him. That night after he went to bed he lay awake almost an hour thinking about it. Either before or after he went to sleep, he never knew which, an idea entered his mind and was there when he awoke next morning.

Right after eight o'clock Sparks headed for the car department.

"Want me to go with you?" his helper asked.

"No," Sparks replied, "clean up the shop while I'm gone."

When Sparks reached the car department he opened a valve in the line from the cold-water pump. Water flowed in a full stream from the one-inch pipe but with little pressure.

"Going to get the push-button in?" the car foreman came over and asked.

"No, I'm afraid not," Sparks told him. "I was figuring on a flow switch, but I'm afraid there isn't enough pressure to operate one."

WHEN Sparks passed the master mechanic's office on the way back from the car department, the clerk came out and stopped him. "There's a wire from Sanford says the automatic boiler control is out of order. They want you to go on the Limited at 9:30 and fix it."

"I didn't know the automatic controls were installed on the boiler at Sanford," Sparks said.

"I don't know anything about it," the clerk said. "All I know is this wire came a few minutes ago."

"O. K." Sparks didn't wait to argue, but headed for the electric shop and started gathering up tools.

He arrived in Sanford about noon, rushed over to a restaurant and ordered a cup of coffee and a meal to go with it. That disposed of, he went to the boiler room.

"Water-service men did the wiring," the fireman in the boiler room explained. "They were in a rush and said the electricians couldn't get to it."

"Who told them how?" Sparks wanted to know.

"Some expert from the company that sold the equipment," the stationary fireman said.

"Well," Sparks remarked, "the man that told them how may be an expert in his line, but evidently is a little out of practice in wiring. I would like to know how they pulled five No. 14 wires through half-inch conduit with those short kinks in it."

"They put the wires in the pipe then bent it," the fireman explained.

Sparks walked around looking at the equipment. Except for the job of wiring, it appeared to be an excellent outfit. The electrician studied a blueprint fastened inside the cabinet door and found that while apparently complicated, operation was really comparatively simple. Starting with the fire out, operation was, he found, as follows: Pressure-switch contacts closed when the steam pressure dropped to a predetermined point. The pressure-switch contacts closed a relay circuit that turned on gas for the pilot light and started the oil-burner motor. An electric eye operating from the pilot flame caused a relay to close which opened the fuel-oil valve; shortly thereafter a delay switch caused the gas to the pilot flame to go out. A three-electrode water-level control regulated the supply of water to the boiler and shut off the fire if the water became too low.

Sparks tested the wiring and found it to be grounded in the conduit. He removed a Condulet cover and found it full of water which explained the ground.

"How in thunder did all of this water get in the conduit?" Sparks asked.

"Don't know," the fireman replied, "unless it got in there yesterday when they washed the boiler."

Sparks then began to examine the wiring more closely. He found everything grounded except the three-phase line to the feedwater pump motor. He also found a piece of conduit running just over the fire door nearly red hot. Insulation on the wires in that particular piece of conduit was charred so that a little rubbing would reduce the rubber to powder.

"How soon will you get it fixed?" the fireman asked.

"You can still fire by hand, can't you?" Sparks asked.

"I'm firing by hand now."

"O. K., you'll probably have to keep firing by hand for the next week or ten days. I've got to pull all of this wire out and do the whole job over and do it right."

"It won't take ten days to do the wiring, will it?"

"No," Sparks told him, "but I've got to have some material. I hope there's enough for the job at Plainville. If there's not, no telling how long it'll be."

The electrician started in disconnecting wires and pulling them out of the conduit, or rather trying to pull the wires out because most of them wouldn't come. After breaking several wires he gave up and started cutting the conduit with a hack-saw.

Sparks worked until five o'clock removing the conduit and wiring, then made a list of material required to replace it properly. He just had time to clean up, eat and catch the Limited back to Plainville at 6:45.

SEATS were scarce on the train, but Sparks found a vacant spot in a smoker. After he had filled out a pass slip, he took out his notebook and checked the various items of material that would be needed at Sanford, then his subconscious mind which scientists say never sleeps called attention to the fact that the problem of starting and stopping the cold-water pump motor at Plainville was still unsolved.

Not having any definite idea in mind, Sparks began "doodling." Evidently the subconscious mind has some control over even such unpremeditated actions as drawing apparently haphazard designs, because Sparks' "doodling" followed a fairly definite pattern consisting mostly of square or rectangular boxes with and without lids.

Just as the conductor came in for tickets, Sparks stopped doodling and eyed one of the figures he had absent-mindedly drawn. "I believe I've got it!" he spoke aloud.

"You mean your pass?" the conductor inquired.

"No—yes—here's a pass slip." Sparks fumbled and started to hand the conductor the notebook. "I was thinking about something else," he explained a little sheepishly.

Next morning Sparks went to the boiler foreman and told him that he would like to have a box made of quarter-inch boiler steel with a half-inch flange and cover to fit one side, the box to be four inches square and eight inches long.

"What's it for?" the boiler foreman wanted to know.

"I'll tell you later," Sparks promised, "if it works."

When the box was finished, Sparks cut a piece of 1/16-in. steel that fitted loosely crosswise in the box. Then he secured two old valve bonnets. When the thing was finished he had a flow switch that he hoped would work. By making the flow switch square instead of round, the paddle could be fashioned to close the opening almost entirely and thus a very slight flow of water would cause the paddle to move. The valve bonnets were used for packing glands for the rod to which the paddle was fastened. A lever arrangement on one end of the rod actuated a mercury tube switch, taken from the pressure switch, thus making contact.

Sparks finished the switch, then persuaded a water-service man to weld pipe connections on each end and connect it in the cold-water pump discharge line. He connected wires from the motor controller to the mercury switch, then went to the car department and turned on the water. He waited a minute that seemed ten—the water flowed sluggishly from the pipe—a half minute more and the same thing. He started to close the valve and admit he was wrong when suddenly the water came with a force that almost jerked the hose from his hand.

He closed the valve and waited four or five minutes to make certain the paddle of the flow switch had time to get back to off position and tried it again. The motor had shut off and it took about the same length of time as before for the motor to start again when the valve was opened.

Sparks tried the flow switch several times, then satisfied it was O. K., went to the master mechanic's office.

"What did you find at Sanford?" the master mechanic asked.

Sparks explained about the wiring and told him the job would have to be done over.

"They would have been ahead by waiting," Carter remarked. "Have you figured any more on a push-button station for the cold water pump?"

"No, sir," Sparks admitted.

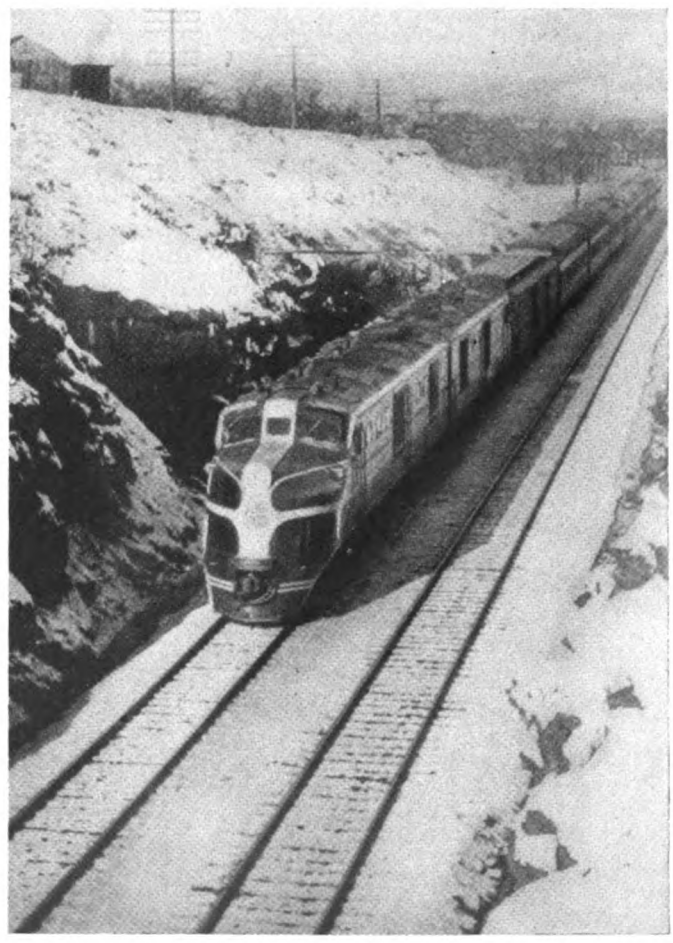
"Why haven't you?" Carter raised his voice slightly so that only the lower panes of the windows rattled.

Sparks grinned. "I couldn't get material for the control line, but I don't believe we'll need it." He explained about the flow switch.

"If it works you can have New Year's day off," Carter growled.

Sparks and his wife celebrated Christmas by staying out until midnight New Year's eve and sleeping late New Year's day. Next day after his late Christmas, he went to Sanford and rewired the boiler controls.

* * *



A New Haven passenger train, hauled by a two-unit Alco-General Electric 4,000-hp. Diesel-electric locomotive

NEW DEVICES

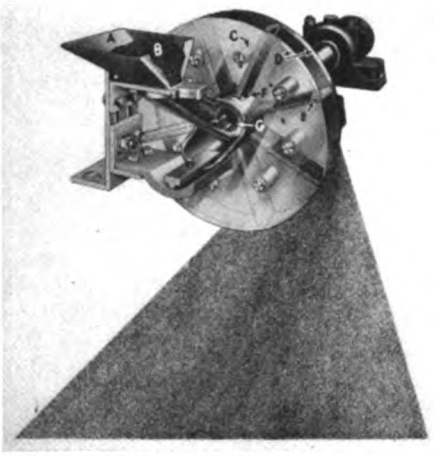
Cleaner for Boiler Tubes and Flues

A mechanical unit for abrasive blast cleaning in removing scale from locomotive boiler tubes and flues has been introduced to the railroad shops by Joseph T. Ryerson & Son, Inc. Known as the Ryerson American Wheelabrator flue cleaner, the machine built by the American Foundry Equipment Company, Mishawaka, Ind., utilizes many of the features developed by that company for use in regular foundry practice in the cleaning of castings.

The Wheelabrator is a simple mechanical unit that utilizes controlled centrifugal force instead of compressed air for abrasive blasting. Designed for use with mechanically handled boiler tubes, rotating flues are carried through the machine one at a time. In the Wheelabrator process abrasive from an overhead storage hopper is fed to the center of a wheel, whereupon it is hurled under control upon the work to be blasted.

The cabinet in which the Wheelabrator is housed is built up of heavy steel plate, reinforced by angles welded in place. At points where abrasive action is greatest replaceable wear plates are provided. Tubes or flues enter and leave the cabinet through small vestibules in which a series of baffle curtains prevent the escape of the abrasives used.

The blast unit, simple in design, utilizes



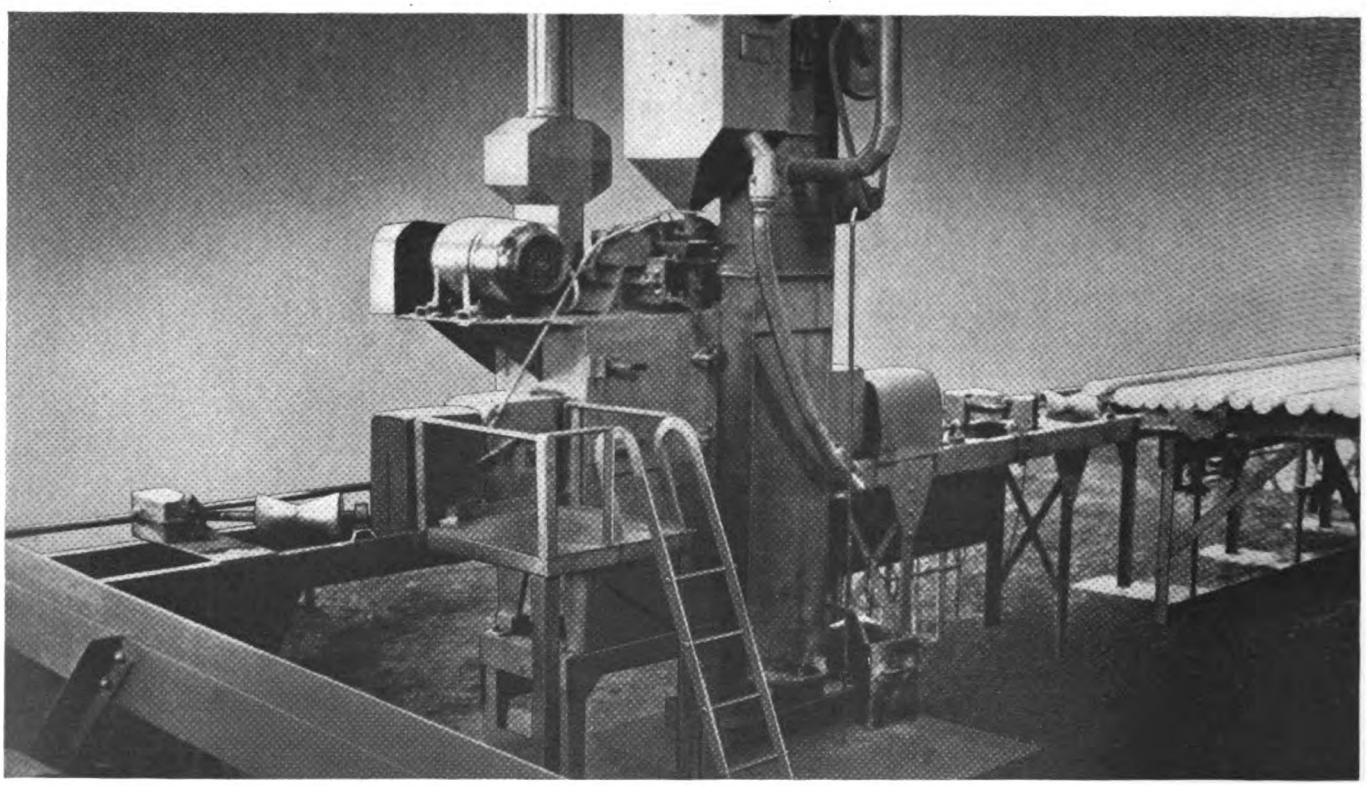
A key to the Wheelabrator parts

A—Abrasive funnel
B—Abrasive metallic shot or grit
C—Spacers between side plates
D—Special steel side plates
E—Removable cast alloy blades
F—Cast alloy control cage (stationary)
G—Cast alloy impeller (rotates with wheel)

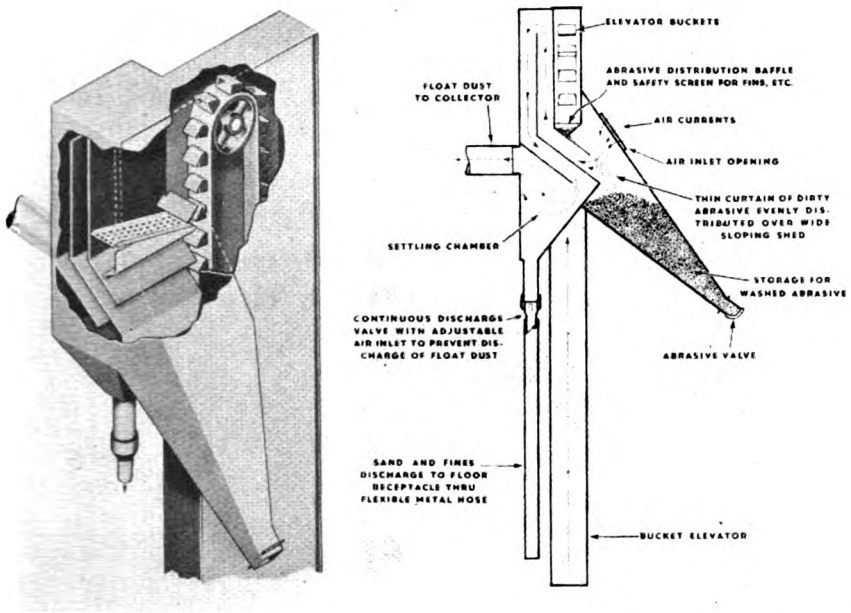
controlled centrifugal force for abrasive blasting and is mounted at the top of the cleaning cabinet in direct line with the travel of the work piece. The plan view shown indicates the operating characteristics of the Wheelabrator unit. Metallic shot or grit, or a mixture of the two, is fed into the funnel (*A*) from a storage hopper. A cast-alloy impeller (*G*) rotates with the motor-driven wheel at high speed and forces the shot or grit through an opening in the stationary control cage (*F*) where it discharges to the bladed section of the wheel. At this point, the abrasive is picked up by the inner ends of the throwing blades (*E*) and it is gradually accelerated in its movement to the periphery of the wheel. Final throwing velocity is the result of radial and tangential forces.

After ragged ends have been cut off from the tubes or flues to be cleaned they are fed onto constantly rotating conveyor rolls leading to the blast cleaning cabinet. These skew-dished conveyor rolls serve to move flues through the Wheelabrator cabinet at speeds ranging from 8 ft. to 29 ft. per min. For 2-in. or 2¼-in. tubes the speed rate is between 15 ft. and 24 ft. per min. depending upon the condition and amount of scale to be removed. Speed is manually controlled by the operator in charge.

All rolls are driven by bevel gears and a line shaft. A one-horsepower motor, operating through variable-speed reducers, is required to operate the conveyor. Rolls inside the blast cabinet are made of special abrasive-resisting metal to withstand the severe service to which they are subjected. Rolls outside the cabinet, not subject to abrasive wear, are cast iron. These conveyor rolls are set at such an angle that they serve to rotate the flues as they pass through the cabinet in the path of the blast.



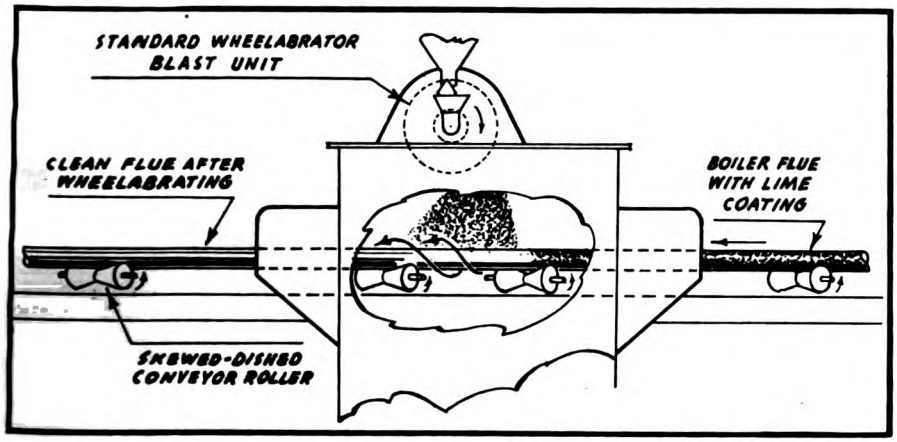
The Wheelabrator utilizes controlled centrifugal force instead of an air blast for abrasive cleaning



A gravity type abrasive separator saves all shot and grit which can be reused

Depending upon the density of the scale to be removed, various sizes of metallic abrasives may be used. For ordinary cleaning metallic grit mixed with a small portion of shot has been found to be effective. Shot hits harder in breaking down heavy scale on the flues, while the grit abrasive has a greater cutting action. This mixture cleans the scale in pits on heavily pitted tubes as well as breaking down and removing scale on unpitted portions of the tube wall. When shot is used alone the surface resulting is fairly smooth but indented; grit produces a rougher finish. Variations in finish can be obtained by using various sizes of shot, of grit, or of both.

The abrasive and scale resulting from the blasting operation are carried by a bucket elevator to a combination abrasive separator and storage hopper. Here it is distributed in a thin curtain over an inclined shed. In flowing off the shed, the abrasive and scale passes over an air duct before falling into the storage bin. The current of air in this duct is drawn through the abrasive and scale curtain and carries away the sand, dirt and abrasive fines into a settling chamber which empties into a receptacle on the floor. Any remaining fine dust is carried in the exhausted air to a dust collector. Usable abrasive, which is deposited in the storage hopper, is fed to the Wheelabrator unit under valved control for recycling.

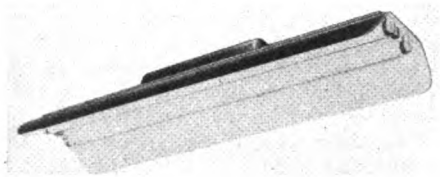


Boiler tubes travel through the cleaning cabinet at rates of speed depending on their sizes and scale condition

Composition Fluorescent Fixtures

Sylvania Electric Products, Inc., Ipswich, Mass. (formerly Hygrade Sylvania Corp.), announces eight new industrial fluorescent fixtures with composition reflectors. The manufacturer states that their reflection factor is even greater than that of porcelain enameled steel reflectors.

The fixtures range in size from 100 to 300 watts, and are available for either individual or continuous-row mounting. The reflectors are finished in Miracoat baked white enamel, and the outside of the units in French gray. The units are furnished

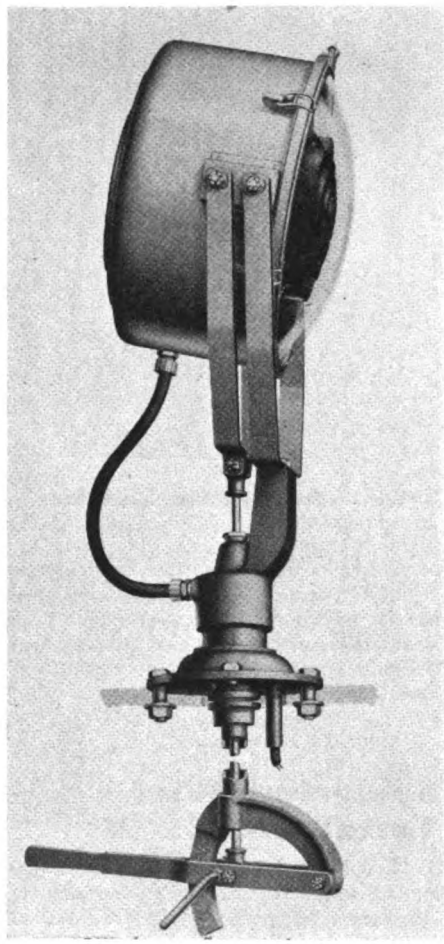


A fluorescent lighting unit with two 40-watt lamps, for individual mounting

complete with lamps and Mirastat starters. Slide-Grip hangers are included with all continuous-row models.

Searchlight

Revere Electric Mfg. Company, Chicago, announces the development of dust, bug and weather-tight incandescent searchlights for varied industrial uses. They are available with 12- and 18-in. lenses and are particularly suited for protective lighting at ordnance plants, industrial plants, bridges, oil storage yards, public utilities, aboard ships or other patrol lighting needs. They offer a multiplicity of mounting arrangements to suit any condition, including pilot house control.



Searchlight with pilot house mounting

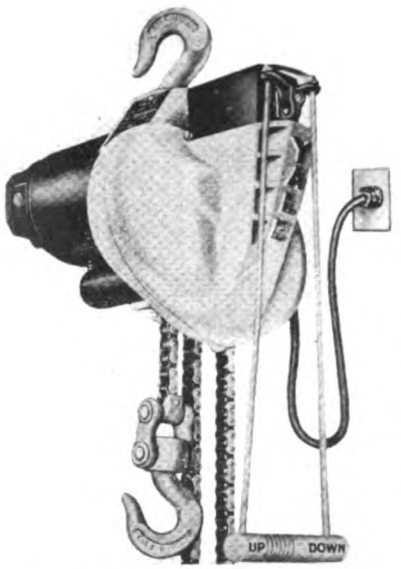
A beam of high candle power is pro-

duced by a precision ground polished silvered glass reflector, as well as an accurate polished metal secondary reflector for added efficiency. The searchlights are designed for continuous operation with 1500-watt lamps in the 18-in. size and up to 600 watts in the 12-in. size. Wattages of 2,000 and 1,000 can be used in the 18-in. and 12-in. searchlights respectively if used intermittently.

When used in a pilot house, the unit is equipped with a friction clutch and rotation stop. The elevating quadrant is furnished with degree markings for setting at any predetermined angle.

Portable Electric Hoists

Electric hoists in capacities of ⅛, ¼, ½ and 1 ton are being manufactured by the Yale & Towne Mfg. Co., Philadelphia Division, Philadelphia, Pa., and distributed under the name Midget King. The hoists are made as either alternating or direct-current units. Light enough in weight to be readily carried about a shop, the hoists are available for service wherever there is an electric outlet and a place to hang them. All units are tested with a 50-per-cent overload before they leave the factory.



Yale & Towne portable electric hoist

Solderless Wire Terminals

A "Hand-die" installation tool for applying lug terminals to electric wires and cables is now being made by Aircraft-Marine Products, Inc., Elizabeth, N. J.

The tool makes three crimps in the lug to produce an electrical and mechanical connection with the wire. An insertion gauge automatically positions the terminal. The crimping jaws for both wire and insulation are tool-steel dies adjustable to accommodate various insulation and wire diameters. A 15-to-1 leverage on the self-opening handles makes for easy operation. When the jaws are closed tightly, a perfectly crimped connection has been made; there is no choice of pressure necessary by the operator. Wire sizes are marked on the tool which may be made left or right handed as needed.



One squeeze of the crimping tool makes an electrical connection which is also mechanically secure

Metallic Water Connections

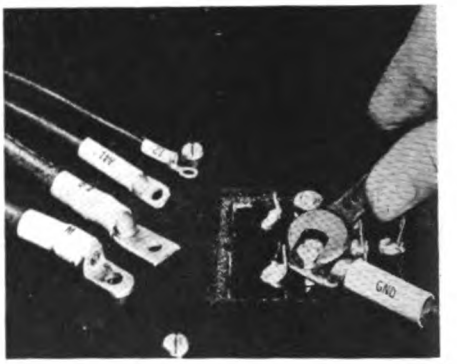
Since the scarcity of rubber during the present emergency will effect to a greater or less extent the availability of rubber hose for use as water lines between locomotives and tenders, the T-Z Railway Equipment Company, Chicago, has developed a new arrangement of T-Z tender tank valve and water strainer, connected to the locomotive and the tender by flexible metallic connections, as a means of taking care of the vertical and lateral movements in service.

Two of the three flexible joints employed are rigidly attached, one to the locomotive and the other to the tender, by braces or supports and connected to the piping from the injectors on the locomotives and to the tank valves on the tender. A T-Z hose coupler and water strainer, applied on the horizontal portion of the piping, has three functions; it can be quickly separated when the tender is to be removed from the locomotive; the strainer may be readily removed for cleaning, and the piping can be drained at its lowest point to avoid bursting in winter weather.

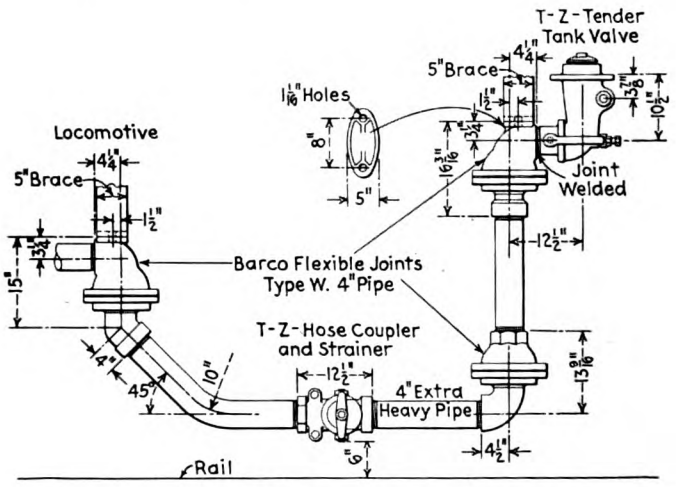
Insulators and Wire Markers

Short lengths of extruded plastic tubing which serve as insulators of terminal connections and as wire markers are being produced by the Irvington Varnish & Insulator Company, Irvington, N. J.

The tubing is marked in legible numerals of the customer's choice, printed with an ink that has resistance to chemicals, water and oils equal to that of the tubing itself. Smooth inside surfaces permit quick application over wires and lugs and the material used has high dielectric strength. The markers are available in colored tubing with either black or yellow symbols, in A. S. T. M. sizes from No. 9 up to ⅜-in. inside diameter. Larger sizes may be obtained on request. Other tubing made from less critical plastic materials can be printed and utilized solely as wire markers.



The plastic sleeves mark the wire, insulate the lug and protect the cut end of the wire insulation



Rubber is conserved by proposed metallic water connection between locomotive and tender

High Spots in
Railway Affairs . . .

Railroaders Commended For Buying War Bonds

Three railroads have thus far received certificates of award from the U. S. Treasury Department for going over the top in the purchase of War Bonds under the 10 per cent payroll savings plan. They include the Boston & Maine, the Mississippi Central and the Lehigh & New England.

Are We Dumb?

As one knocks about the country he cannot but be impressed by the fact that many railway employees take a considerable interest in community and public affairs. The Railroad Y. M. C. A. has aggressively promoted citizenship training and public affairs discussions for a number of years, and more particularly since its Commission on Responsible Citizenship was set up in 1939. It has even gone so far as to compile and publish a Citizenship Training Manual. A survey made by the magazine Fortune and based on nine simple questions relating to current affairs indicates that 38 per cent of the railway employees are "poorly informed" and 35 per cent "uninformed." Only about 27 per cent, therefore, are rated as being "well informed." It is not surprising to learn that railroaders, at that, were not rated at the bottom of the list in Fortune's report. Railroad men do get around a good bit and transportation is so fundamental to American economy that railroad employees would naturally be expected to have a broader perspective than workers in many other fields. Lower percentages of "well informed" were found among factory, personal-service and mining employees.

First-Quarter Car Loadings

Our American economy is being badly upset by war conditions and it is becoming increasingly difficult to estimate very far ahead just what will be the civilian requirements for rail transportation. Every day, these winter months, new rules or suggestions are being made for rationing, or as to the restriction of production along non-essential lines—that is, non-essential from the viewpoint of waging war. One of the best gages for forecasting freight traffic is the estimates made by the thirteen Shippers Advisory Boards. Eight of the thirteen boards estimate an increase of freight car loadings on the 28 principal commodities during the first quarter of 1943. The Pacific Northwest, the Trans-Missouri-Kansas, the Southeast, the Atlantic States and the New England boards estimate decreases. The net result, however, is a prediction that freight car loadings, as a whole, will be increased about 3.4 per cent over the loadings in the first quarter of 1942. An increase is expected in the loading of 10 of the 28 commodities; among these are cotton seed and products, except oil, 22.2 per cent; manufactures and miscellaneous, 18.4 per cent; livestock, 14.6 per cent; grain, 10.9 per cent, and potatoes, 10.5 per cent. Some of the more important commodities for which decreases are estimated include agricultural implements and vehicles other than automobiles, 45.4 per cent; sugar, syrup and molasses, 18.4 per cent; paper, paper board and prepared roofing, 10.7 per cent, and lime and plaster, 10.3 per cent.

Pullman Carries Troops

The Pullman Company made a remarkable record in 1942. It handled 18 million civilian passengers, carrying them a total of 10 billion passenger-miles and breaking all records since 1931. At the same time it transported more than eight million soldiers, sailors and marines a total of more than nine billion passenger-miles. The troop movements are being made by a mobile fleet of more than 7,000 cars, which are set aside for seasonal, holiday or emergency peaks in business. This troop movement was not spread evenly over the year, but has increased steadily ever since Pearl Harbor. During the last three months of 1942 the rate was at more than 800,000 per month.

Tribute to Uncle Sam

In the early days of this country many of the railroads were encouraged to extend their lines into undeveloped territories because of land grants from the federal or state governments. This proved to be a good bargain for both parties. It opened up the country to settlers and facilitated its development, and at the same time reacted to the advantage of the railroads. Jefferson, when President in 1803, made the statement that it would be a thousand years before the region east of the Mississippi could be fully settled. But Jefferson reckoned without the railroads! They made possible the speedy opening up and development of the Far West and the welding of the states into a greater nation. Uncle Sam, however, is frequently a sharp bargainer. The land grant roads were forced to carry government property at special rates. The story is told statistically and graphically in an exhibit which was recently released by the Transportation Board of Investigation and Research. Up to June 30, 1942, the savings to the government because of land grant reductions for carrying troops and government property amounted to more than $340,000,000. It is estimated that at the present time the savings amount to at least $20,000,000 a month. The report points out that the savings to the government in connection with traffic moving over land grant roads have accounted for a considerably smaller part of the total savings than have the equalization agreements entered into by non-land grant roads competing for government traffic. Uncle Sam is certainly being paid at a handsome rate for the land grants, and the ironical part of it is that the non-land grant roads are now making the greater part of the contribution.

Export Traffic and the Rails

The average number of cars of export freight unloaded at North American ports in 1942 was nearly 16 per cent greater than the number handled in 1918 in the first World War. The average tonnage per car in 1942, however, was much greater. The effect of waging wars on both oceans is indicated by the fact that one-third of the total export freight is now moving to Pacific ports; there was only a small amount in that direction in 1918. These movements of export freight are being handled without any congestion, or as expressed in a report of the Association of American Railroads, every port in the United States is in a completely "liquid" condition. Approximately 2,500 cars of export freight are now being unloaded daily.

Oil Shortage

The eastern part of the country is shivering in the attempt to struggle through the winter with poorly heated homes and buildings. Householders with well-filled coal bins in their cellars are wearing a smug expression of satisfaction, but those who are dependent on the current delivery of coal or on fuel oil or gas heating are anything but comfortable. The railroads continue to do an exceptionally good job in moving the oil, but seem to have about reached the maximum capacity of the present tank car equipment. The floods interfered somewhat with the movement during the latter part of the year, but the latest record available at this writing—that for the week ended January 2—shows that the daily tank car movement averaged 775,409 barrels, an increase of 74,582 barrels a day over the previous week. Some slight improvement has been registered by the shipment of kerosene in steel drums in box cars. The Army has made available 200,000 steel drums for this purpose and it is hoped to move about 6,500 barrels of kerosene daily by this method. Pipe-line pumping capacity is being increased, but it is not expected that substantial increases will be made in such deliveries until extensions of the Plantation Pipe Line into Virginia and the new line from the Ohio River to Philadelphia are placed in operation.

Among the Clubs and Associations

CAR DEPARTMENT OFFICERS' ASSOCIATION.—Owing to the pressure of other duties in connection with his recent promotion to the position of assistant to the vice-president of the Chicago, Burlington & Quincy, F. L. Kartheiser has tendered his resignation as secretary-treasurer of the Car Department Officers' Association after serving the association in this capacity for five years. The board of directors has appointed F. H. Stremmel, assistant secretary, Association of American Railroads, Mechanical division, to fill Mr. Kartheiser's unexpired term of office. The business of the Car Department Officers' Association will be conducted by the new secretary-treasurer from his office at 6536 Oxford avenue, Chicago.

EASTERN CAR FOREMEN'S ASSOCIATION.—Meeting held on January 8 in the Engineering Societies building, New York. ¶ The following were elected to serve for the year 1943: President, B. F. Cordts, engineer, cars and shops, Independent Subway System, New York; first vice-president, K. H. Carpenter, superintendent car department, Delaware, Lackawanna & Western, Scranton, Pa.; second vice-president, F. H. Becherer, superintendent car department, Baltimore & Ohio, Baltimore, Md.; treasurer, T. G. Case, general car foreman, New York Central, New York, and secretary, W. P. Dizard, 30 Church street, New York. ¶ Following the election of officers, a panel discussion was held relating to changes which have been made in the A. A. R. Rules of Interchange which were issued as of January 1, 1943. The discussion was led by G. B. Williamson, chief, A. A. R.

Five Awards Made by St. Louis Car Men

Car Department Officers Association of St. Louis.—Meeting held December 15 at St. Louis, Mo. Presentation of awards to winners of the contest for the best short paper presented by railroad men from the ranks during the 1942 season. ¶ Six papers in all were presented and awards made as follows: First prize of $25.00, to H. J. Flannigan, carman helper, Illinois Central —"Lubrication" presented at the meeting on April 21, 1942; second prize of $15.00, to G. H. Pollard, draftsman, Missouri Pacific—"Engineering in Connection with Car Construction and Maintenance," presented at the meeting on September 15, 1942; third prize of $10.00, to Ray C. Milz, foreman, Pullman Company—"Safety and the New Man," presented at the meeting on September 15, 1942. ¶ The other contestants, each of whom deserves praise for a very creditable effort, were awarded a prize of $2.00 each. They are: E. L. Schaffner, gang foreman, Pennsylvania—"Periodic Attention to Passenger Cars," presented at the meeting on March 17, 1942; E. F. Davis, electrical foreman, New York Central —"Conservation of Electrical Equipment by Close Inspection," presented at the meeting on May 19, 1942; and E. Warning, leadman, Missouri Pacific—"Responsibility of Repair Track Forces in Maintaining Equipment." presented at the October 20, 1942, meeting.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

ALLIED RAILWAY SUPPLY ASSOCIATION.—J. F. Gettrust, P. O. Box 5522, Chicago.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. —H. H. Henleine, 33 West Thirty-ninth street, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.— C. E. Davies, 29 West Thirty-ninth street, New York.
RAILROAD DIVISION. — E. L. Woodward, *Railway Mechanical Engineer,* 105 West Adams street, Chicago.

ANTHRACITE VALLEY CAR FOREMEN'S ASSN.— Victor H. Deppe, general secretary, Mountain Top, Pa. Meets January, March, May, July, September and November at Scranton, Pa. February, April, June, August, October and December at Wilkes-Barre, Pa.

ASSOCIATION OF AMERICAN RAILROADS.—Charles H. Buford, vice-president Operations and Maintenance Department, Transportation Building, Washington, D. C.
OPERATING SECTION.—J. C. Caviston, 30 Vesey street, New York.
MECHANICAL DIVISION.—A. C. Browning, 59 East Van Buren street, Chicago.
PURCHASES AND STORES DIVISION.—W. J. Farrell, Executive Vice Chairman, Transportation Building, Washington, D. C.
MOTOR TRANSPORT DIVISION.—George M. Campbell, Transportation Building, Washington, D. C.

CANADIAN RAILWAY CLUB.—C. R. Crook, 4415 Marcil avenue, N. D. G., Montreal, Que. Regular meetings, second Monday of each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS.— J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, DeSoto Hotel, St. Louis.

* * *

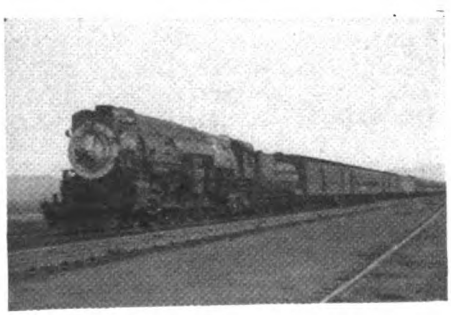


Photo by Hugh F. O'Neil

S. P.'s Second 88 Eastbound, Near Montello, Nev.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—J. H. Stremmel, 6536 Oxford avenue, Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—W. J. Burns, second vice president, General American Transportation Corp., Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.— H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1840-2, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday of each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION.—W. P. Dizard, 30 Church street, New York. Regular meetings, second Friday of January, February (annual dinner), March, April, May, October, and November at Engineering Societies Bldg., 29 West Thirty-ninth street, New York.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.— H. T. Bramblett, care of H. P. Ruck, car foreman, Pennsylvania, 764 South Emerson avenue, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, in Indianapolis Union Station, Indianapolis, at 7 p. m.

LOCOMOTIVE MAINTENANCE OFFICERS' ASSOCIATION.—Secretary-treasurer C. M. Lipscomb, Missouri Pacific, North Little Rock, Ark.

MASTER BOILER MAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

MIDWEST AIR BRAKE CLUB.—C. F. Davidson, secretary-treasurer, general inspector car department, St. L.-S. F., Springfield, Mo.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings second Tuesday in each month, except June, July, August and September, at Hotel Touraine, Boston, Mass.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Thursday in each month, except June, July, August, September and December at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings first Monday each month, except June, July and August, at Midway Club rooms, 1931 University avenue, St. Paul.

NORTHWEST LOCOMOTIVE ASSOCIATION.—G. T. Gardell, 820 Northern Pacific Building, St. Paul, Minn. Meetings third Monday of each month, except June, July and August.

PACIFIC RAILWAY CLUB.—William S. Wollner, P. O. Box A, Sausalito, Calif. Regular meetings, second Thursday of each alternate month at Palace Hotel, San Francisco, Calif., and Hotel Hayward, Los Angeles.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 308 Keenan Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, Room 811, Utilities Building, 327 South La Salle street, Chicago.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION. —J. D. Conway, 308 Keenan Building, Pittsburgh, Pa.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.— A. T. Miller, 4 Hunter St., S. E., Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July, and August at Royal York Hotel, Toronto.

WESTERN RAILWAY CLUB.—E. E. Thulin, executive secretary, 122 South Michigan avenue, Chicago. Regular meetings, third Monday in each month, except June, July, August, September, and January, Hotel Sherman,

(*Turn to next left-hand page*)



CHILLED CAR WHEELS HELP "Pass the Ammunition"

A veritable flood of war materiel is pouring from American factories. The transportation of these finished tools of war and the enormous quantity of vital raw materials necessary in their production, depends almost entirely upon the railroads. Never before have the railroads produced so much transportation – under so much pressure! Chilled Car Wheels help keep freight cars rolling. ● More than 15,000,000 Chilled Car Wheels are now in freight service ● With 38 foundries strategically located in the United States and 8 in Canada, the railroads are assured of quick delivery and reduced wheel delivery costs. ● Under our unique wheel exchange plan, by which you receive new wheels for old on a conversion charge basis, scrapped chilled wheels are speedily melted and recast into new and better wheels. Thus, vital material is conserved, delivery of new Chilled Car Wheels is expedited, defense production is accelerated and Victory hastened.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

3196

NEWS

ODT'S "Claimant Agency" Status

OFFICIAL announcement of the fact that the Office of Defense Transportation had been made a "claimant agency" under the War Production Board's Controlled Materials Plan was made by WPB on January 8. To perform the functions thus developing upon ODT, Director Eastman on the following day announced the establishment of a Division of Material and Equipment Requirements, replacing the Section of Materials and Equipment.

As noted in the January issue, page 65, where the decision to make ODT a claimant agency was reported, the WPB action takes the transportation industry out from under the wing of the Office of Civilian Supply and gives it a place for itself on WPB's Requirements Committee which doles out available materials. The WPB announcement said that invitations to nominate members to represent them on that committee have been sent to the newly-designated claimant agencies.

"Claimant agencies," as the WPB announcement explained, "act as spokesmen for the various 'customers' using critical materials. They are responsible for making up and presenting their respective programs and compiling requirements of materials to meet them. This is being done both for current requirements and for future requirements to be submitted under the Controlled Materials Plan when it becomes effective April 1.

"Each claimant acts as proponent of its own program and carefully examines the programs of others. In this way views of all interested parties are expressed. After full discussions of the programs and requests of the respective claimants, the chairman of the Requirements Committee, with the advice of the committee, makes allotments of materials to meet definite approved programs If adjustments in individual programs are necessary as a result of the final allotment, the claimant is responsible for making them. The claimant is also responsible for seeing that the approved program is carried out."

The ODT organization change makes Warren W. Kelly, who has been director of the Section of Materials and Equipment, director of the new Division of material and Equipment Requirements. Mr. Kelly, former general purchasing agent of the Atchison, Topeka & Santa Fe, came to ODT last June. Associate director of the new division will be A. L. Sorensen, former manager of stores of the Erie who has been assistant to the vice-president, Operations and Maintenance Department, Association of American Railroads, since early last year. Carroll W. Brown, who has been assistant director of the replaced section, will continue as assistant director of the new division.

The changes, according to the ODT announcement, became effective January 1; and Mr. Kelly in his new role will report to General Charles D. Young, assistant director of ODT. The functions of the new division were summarized in the announcement as follows:

1. To gather from other divisions of ODT, and other sources, estimates of the requirements of domestic transportation for materials and equipment.
2. To compile these estimates into an over-all integrated domestic transportation requirements program for his approval.
3. To prepare the approved program for presentation to WPB.
4. To arrange, with the advice of other ODT divisions, proper allocations of materials and equipment in accordance with WPB's determination and allotment of the program's requirements.
5. To arrange for the necessary implementation, so that materials and equipment may be forthcoming in accordance with approved schedules.
6. To represent ODT on the various WPB Industry and Material Division Requirement committees.
7. To act as liaison between ODT and all government and private agencies on matters concerning material and equipment requirements for which ODT is claimant agency.

Authority Required To Scrap Old Locomotives

THE War Production Board by an amendment to its Limitation Order L-97 has established "regulatory control" over "the repair, sale, dismantling, scrapping or other disposition of surplus used or idle" locomotives, it was announced January 2. This order, it was said, paves the way for the pooling of surplus or idle used locomotives under regulations to be announced by the Office of Defense Transportation.

In its original form Order L-97 controlled production and distribution of new locomotives. It was pointed out that steadily increasing munitions and ordnance production creates a condition in which maximum use of all available motive power is essential, and repair of used equipment is expected to contribute to this end by adding to the supply of serviceable locomotives, at least for industrial operations, so releasing new equipment for purposes where they are most useful.

The amended order provides that a used locomotive cannot be scrapped or dismantled until specific authority is obtained from the WPB Director General for Operations. An application on Form PD-747 is necessary to get such authorization. The limitation order is administered by the WPB Transportation Equipment Division, but it was emphasized that that division will not control transfers of locomotives among railroads, which remains an ODT responsibility.

Motive Power Shortage Eased by Leasing

LATEST available reports are said by the Office of Defense Transportation to show that 469 freight locomotives, 65 passenger locomotives, 6 all-purpose locomotives, and 166 switching locomotives have been leased by railroads with a motive-power surplus to other roads suffering from serious power shortages. Such shifting of equipment from one road to another has promoted maximum use of motive power under wartime traffic demands, the ODT points out, and has averted difficult situations that threatened to develop before construction of the 386 new locomotives authorized in November, 1942, by the War Production Board.

Among instances cited by the ODT of leasing arrangements made as the result of co-operation between the railroads, the Association of American Railroads, and the ODT, is the transfer of locomotives to other roads from the Duluth, Missabe & Iron Range at the close of the Great Lakes navigation season. Of these, 4 went to the Denver & Rio Grande Western, 4 to the Great Northern, 3 to the Western Pacific, and 7 to the Southern Pacific. In addition, 2 new locomotives ordered by the D. M. & I. R. were delivered to the D. & R. G. W. for use until March, when, with the others, they will be turned back to the owning road as the iron ore move-

(Continued on next left-hand page)

Orders and Inquiries for New Equipment Placed Since the Closing of the January Issue

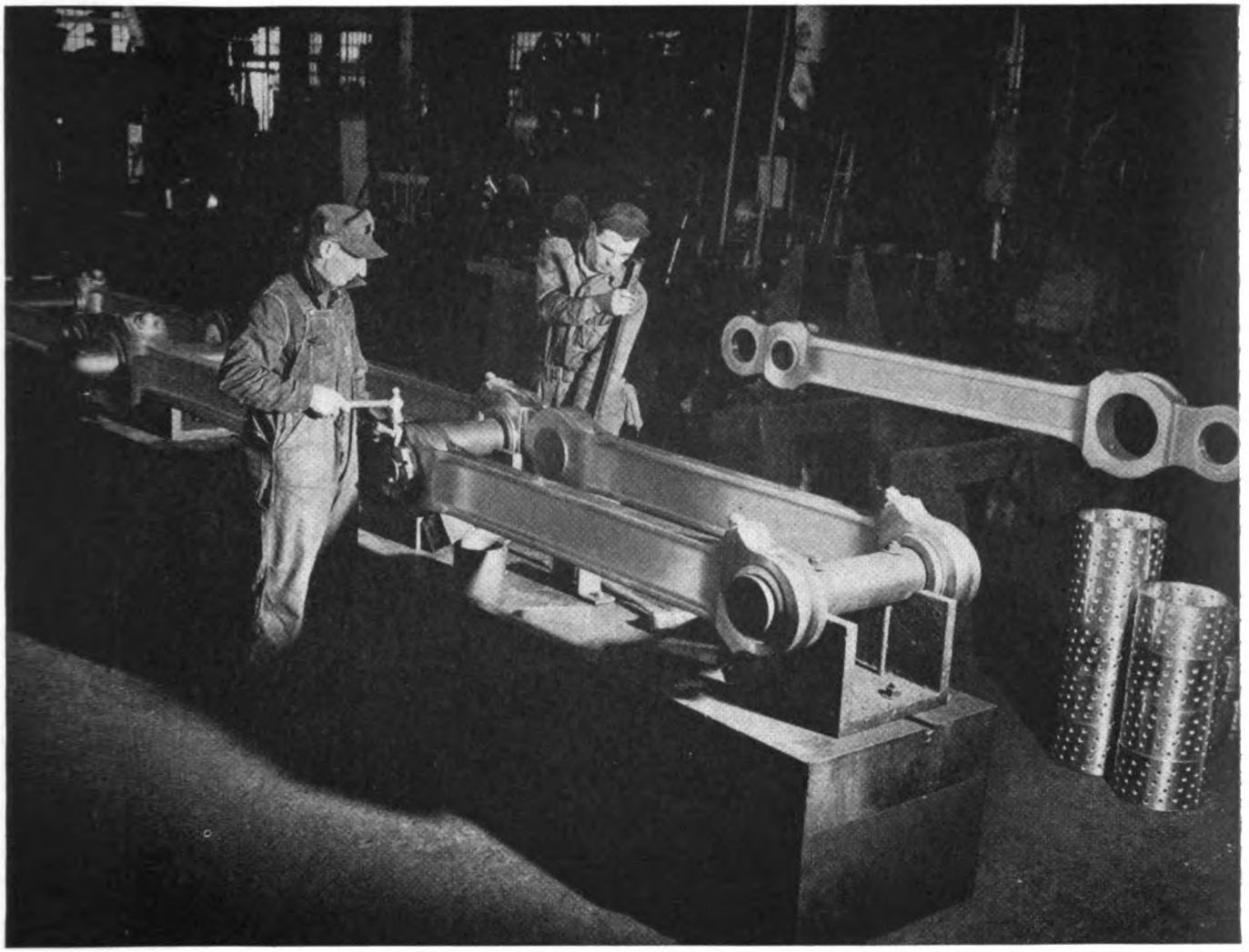
LOCOMOTIVE ORDERS

Road	No. of Locos.	Types of Loco.	Builder
New York Central	25 [1]	4-8-2	Lima Loco. Wks.

FREIGHT-CAR INQUIRIES

	No. of Cars	Type of Car	Builder
Atchison, Topeka & Santa Fe	300	70-ton ballast	———
	200	50-ton flat	———
	200	70-ton gondola	———
	200	50-ton hopper	———
Western Maryland	25	70-ton flat	———

[1] Authorized by WPB. Deliveries expected in July and August.



Typical of the care and accuracy with which Lima power is constructed, is the rod assembly jig illustrated above. The machined rods must fit on these jigs thus insuring interchangeability and avoiding the necessity of adjustment when the rods are applied to locomotives. This care in rod manufacture is one of the reasons why Lima-built locomotives "break-in" easily.

LIMA-BUILT *is Well Built*

To meet war-time traffic demands locomotives are being pushed harder than ever before. In today's emergency Lima-built power is proving its ability to take the increasing burden placed upon it.

The old railroaders at Lima know the service expected of their product and they go to unusual lengths in their manufacturing processes to build the longest possible life into each locomotive part.

This policy is paying dividends for the railroads in the present emergency.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

ment is resumed. By that time it is expected that new locomotives will reach the roads now leasing the D. M. & I. R. power.

Another example of locomotive transfer reported by the ODT involves three railroads. The D. & R. G. W., having obtained 10 Missouri Pacific locomotives, was able to lease 10 of its own to its western connection, the Western Pacific. The Bingham & Garfield also obtained a locomotive from the Denver & Rio Grande Western.

The Chicago & North Western, which had 108 locomotives available for disposal to other roads, has sold some of these to the Mexican government, the ODT states, but most of them have been leased. Roads now using C. & N. W. power include the Atlantic Coast Line, Southern, Seaboard Air Line, Missouri Pacific, and Kansas City Southern. Variations in clearance limitations, load limits, signal equipment and other conditions have restricted the scope of the leasing program, the ODT adds.

Co-operation between railroads to meet the wartime emergency has not been confined to locomotive leasing, the announcement continues, and about a dozen roads have undertaken repair work on off-line locomotives. One large project of this nature, shared by several roads, was the repair of 50 used locomotives sold by various roads to Mexico. In addition, the Norfolk & Western has repaired 52 locomotives for other roads, including 14 for the Atlantic Coast Line and 32 for the Seaboard Air Line.

Greater Use of Bessemer Steel Mandatory

RAILROADS and builders of locomotives freight and passenger cars and equipment specialties were notified in a circular dated January 7, and issued January 18 by the Transportation Equipment Division of the War Production Board, that all orders placed by them following that date for certain items of steel for railroad equipment which have usually been made of open-hearth steel, must clearly allow the substitution of Bessemer steel as an alternative in filling the order.

The new rules, which were invoked to reduce the demand for open-hearth steel, by increasing the utilization of the bessemer process of making steel, extend to 66 items of materials, and further require that all flanging must be formed by the hot rather than by the cold process. The items of material embraced in the order and the instructions governing their purchase, as announced by WPB, are as follows:

To All Railroads, Locomotive Builders, Car Builders and Specialty Manufacturers:

In order to reduce the demand for open-hearth steel for new equipment and repairs, it is requested that, when ordering steel, the purchase order shall specify "either open-hearth or bessemer steel."

1. On flat rolled plates under 7/16-in. thick and structural shapes, when not subject to high stresses, dynamic shocks, severe forming, or cold flanging.

2. Also on items listed below:

Freight Cars	Passenger Cars
Diaphragm web plates except bolster and crossbearer	Diaphragm web plates except bolster and crossbearer
Diagonal braces	Side sheets
Center sill separators	Roof sheets
Floor stringer connections	Corner caps
Floor beams	Branch pipe supports
Door headers	Diagonal brace gussets
Hood sheets	Reservoir supports
Inside finish	Unflanged side sheets
Side doors	Unflanged slope sheets
False floor sheets	

Locomotives

Deflecting plates	Ash pan material
Ex. inj. water reg. rigging	For stoker manifold shield
Booster air manifold bracket	Dome finish body
Door shield s. box ft.	Sand box body
Steam pipe cover	F. bumper step splash plate
Exh. inj. separator support	F. bumper step back plate
Cylinder jacket	Boiler jacket material
Oil pipe bracket	Gage stand (air gage booster and valve pilot)
Mech. lub. oil pipe brackets	Gage stand (stoker and ex. inj.)
Driv. box oil pocket	Gage stand (pyrometer)
Cen. pin. lub. on front foot plate	Valve handle support
Draw pin cover	Cab apron
Frame chafing plate	Cab seat details
Cab bracket	Cab material plates
Tank coal grate plates	Running board plates
Ten frame washout	Running board step
Bumper step kick plate	Engineer's tool box plates
B. bumper step plate splash	Side sheet
Tend. stoker material	Cab vent shaft support
Tank stoker compt. door	Cab seat plate (engineer)
Marker lamp box	Cab drop seat plate
Trainman's cab mat'l	Trailer truck box oil cavity
Trainman's cab drop seat mat'l	Staybolt flexible sleeves unless drop forged
Radial buffer shield	

For such of the above named parts that require flanging, hot flanging only is permitted and the flanged parts must be carefully inspected to see that no defects appear in the flanged corners.

A Second Railway Battalion to Train on the Southern

BECAUSE of the satisfactory manner in which the Southern Railway System trained its own 727th Engineer Battalion—the first of several railroad battalions organized to operate military railroads—the War Department has selected the Southern for the training of another Battalion, it has been announced by Brigadier General Carl R. Gray, Jr., General Manager of the United States Military Railway Service.

The 715th Operating Battalion will receive basic training in all phases of railway operation on the Southern's line between Meridian, Miss., and New Orleans, La., where the 727th underwent training during the latter part of 1942. Headquarters will be located at Hattiesburg, Miss.

Box Cars Refitted for Troop Transportation

THE Pennsylvania has recently brought out new models of the reconditioned box cars on which it has been working with the idea of converting them for use in the transportation of troops. The new models, embodying changes suggested by the Army and Navy after the preliminary demonstrations, have been assembled into an experimental train consisting of a sleeping car, a kitchen car, and a recreation car.

The sleeping car provides space for 32 men in three tiers of bunks; it has portholes for windows, is heated, fireproof, and has sanitary facilities. It has been suggested that the equipment might be used for long-haul troop movements, making it up into 16-car trains consisting of 14 sleepers, and the kitchen and recreation cars. Among those who have inspected the equipment is Director Eastman of ODT who is reported to have been favorably impressed. Meanwhile, the Pennsylvania is understood to be prepared to proceed with the conversion work if the idea receives the approval of the armed services.

Icy Tender Violation of Law

RAILROADS are bound to provide equipment in condition safe to be used, and to maintain it in that condition at all times while it is being operated, the United States Supreme Court has decided, and are liable for injuries suffered by employees on duty resulting from failure to maintain it in such condition without regard to negligence on its own part or that of the employee.

The particular case on which this opinion of the court was based, as announced January 11, is *Lilly versus Grand Trunk Western.*

The employee involved was a brakeman who slipped on ice on a locomotive tender tank while attempting to pull a water spout into position over the tender manhole, then fell to the ground, suffering injuries for which he sought damages. A jury in an Illinois state court returned a verdict in favor of the brakeman, awarding him $32,500 damages, but on appeal the state Appellate Court entered judgment for the railroad. After the Supreme Court of Illinois had refused leave to appeal, the case was taken to the United States Supreme Court, which reviewed the case because it involved interpretations of federal statutes, particularly the Boiler Inspection Act.

As the circumstances are outlined in the Supreme Court opinion, delivered by Justice Murphy, at the time of the accident the surface between the tender manhole and the fuel space, an area of some six square feet, was covered with ice; there was or had been a small leak at the collar of the manhole from which water flowed onto this surface; the brakeman stood on this icy surface while reaching with a rod for the water spout; and as he pulled on the spout his feet slipped on the ice and the rod at the same time slipped on the spout, causing him to lose his balance and fall to the ground.

In the trial court the jury was required to determine whether or not there was a leak in or near the manhole collar at the time of the accident, and this question was answered in the negative. On that ground the railroad's counsel contended, and the appellate court decided, that all question of violation of the Boiler Inspection Act was removed from the case, that there was no evidence of negligence and that the employee assumed the risk, if any.

In reviewing the case the Supreme Court considered two points: (1) Did the presence of ice on the tender top constitute violation of the Boiler Inspection Act irrespective of any leak in the manhole collar; and (2) Was the jury properly instructed in this respect?

To both questions the court's answer is affirmative.

(*Continued on next left-hand page*)

how to AVOID keeping locomotives WAITING FOR REPAIR PARTS!

Franklin is frequently urged to rush repair parts for locomotives undergoing repairs.

Today the delays caused by wrong priorities, difficulty in obtaining materials and the concentration of machines on war work, make it almost impossible to give the former prompt response to such requests.

For your own protection we suggest ordering currently against requirements that you know will be called for by planned maintenance schedules.

This is permissible under WPB regulations and will prevent delay in restoring locomotives to service.



FRANKLIN RAILWAY SUPPLY COMPANY, INC. NEW YORK CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

"Negligence," the court ruled, "is not the basis for liability under the Act." Citing section 2 of the Act—which reads in part, "It shall be unlawful for any carrier to use or permit to be used on its line any locomotive unless . . . all parts and appurtenances thereof are in proper condition and safe to operate in the service to which the same are put, that the same may be employed in the active service of such carrier without unnecessary peril to life or limb"—the court remarks that use of a tender covered with ice does involve "unnecessary peril to life or limb." In support of its conclusion it refers to rule No. 153 of the Interstate Commerce Commission that the "top of tender behind fuel space shall be kept clean and means provided to carry off waste water." Here, it says, the word "clean" involves the "continuing duty" of removing "all extraneous substances" which might make standing hazardous.

The court finds without merit the contention of counsel that the Boiler Inspection Act applies merely to defects on construction or mechanical operation, and remarks that "without limitation" the Act refers to equipment "in proper condition and safe to operate."

Continuing, the Act says, "Conditions other than mechanical imperfections can plainly render equipment unsafe to operate without unnecessary peril to life or limb."

In reaching its conclusion on the second question considered by it, the Supreme Court decided that the jury was properly instructed in the trial court, so that no technical ground for reversing the verdict could be found in this contention.

Having ruled that the brakeman's injuries were the result of violation of the Boiler Inspection Act by the railroad, the questions of contributory negligence and assumption of risk are not available, the court's opinion reads, under sections 3 and 4 of the Federal Employers' Liability Act, "as those sections existed at the date of the accident."

This disposition of the case, it says, makes it unnecessary to consider either whether the railroad was generally negligent, or, if it was in fact negligent, whether the 1939 amendment to section 4 of the Employers' Liability Act—which completely abolishes the defense of assumption of liability of risk by the employee—should be applied retroactively.

1942 Traffic Tops All Records, Pelley Says

CALLING railroad performance last year "one of the outstanding features in connection with the prosecution of the war," J. J. Pelley, president of the Association of American Railroads, in a year-end statement, emphasized that the 1942 traffic comprised the greatest volume that "any form of transportation in the world has ever been called upon to move in any corresponding period."

Reviewing the year, Mr. Pelley said:

"Despite the unprecedented volume, railroads transported it without congestion. Some temporary stringencies in certain types of equipment have occurred but there has been no interference with the war effort because of inability of shippers to obtain cars. The volume handled by the roads amounted to 630,000,000,000 ton-miles. This was 155,000,000,000 ton-miles, or nearly 33 per cent greater than that handled in 1941, the previous record year. It was more than one and one-half times the volume moved in the first World War year 1918.

"This heavy increase in ton-miles resulted from the heavier loading of freight cars and longer haul per ton, carloadings in 1942 having been little more than one per cent greater than in the preceding year. Freight loadings approximated 42,800,000 cars in the current year, an increase of 510,000 cars above 1941.

"At the same time, railroads established a new high record in volume of passenger traffic in 1942. Passenger-miles (the number of passengers multiplied by the distance carried) totaled 53,000,000,000. This exceeded by more than 6,000,000,000 passenger-miles, or 13 per cent, the previous record established in 1920. It also exceeded 1941 by more than 23,000,000,000 passenger-miles, or 80 per cent.

"Part of this heavy passenger traffic in 1942 can be attributed to troop movements, approximately 2,000,000 members of our armed forces now being transported monthly in organized movements.

"Railroads have been able to meet transportation remands in 1942 because of improvements in equipment construction and a continuous improvement in operating efficiency. . . . The average speed of both freight and passenger trains in the current year was slightly less than in 1941 but this has been more than compensated for by the increase in the amount of freight and number of passengers carried per train.

"Among the outstanding efficiency records established by the railroads in 1942 were the following:

"1. Average load of freight per train was 1,030 tons, the highest on record. In 1941, it was 915 tons.

"2. Performance per freight train has more than doubled, gross ton-miles per freight train hour having increased from 16,555 in 1921 to 35,874 in 1942, while net ton-miles per freight train hour increased from 7,506 in 1921 to 16,216 in 1942.

"3. For each pound of fuel used in freight service in 1942, railroads hauled 9.2 tons of freight and equipment one mile compared with 6.2 tons in 1921.

"4. The average load per freight car was 31½ tons in 1942, the highest on record.

"5. The average haul of freight shipments in 1942 broke all records, increasing by approximately fifty miles compared with the preceding year.

"6. Average daily movement of freight cars was 49 miles in 1942, a new high record, and an increase of 90 per cent compared with 21 years ago.

"7. Average passengers per car and per train broke all previous records by a wide margin, the load per car being more than 40 per cent and the load per train being more than 60 per cent greater than in 1941.

"8. Average capacity of freight cars was 50½ tons in 1942, the highest on record.

"9. Average daily movement of freight locomotives in 1942 was 122.5 miles, or an increase of 57 per cent compared with 1921.

"10. Tractive force of locomotives averaged 52,000 lb., an increase of 40 per cent compared with twenty years ago.

"Railroads in the first eleven months of 1942 installed in service 60,789 new freight cars and 668 new locomotives. Demand for materials needed for other war purposes, especially steel, has resulted in a reduction in the amount of materials allocated by the government for new railroad equipment. Otherwise, the number of new cars and locomotives put in service this year would have been greater. The supply of certain types of equipment, such as flat, gondola and hopper cars, has been at times barely adequate to take care of traffic demands. Additional equipment will be needed to enable the railroads to continue to meet transportation demands. Expectations are that greater war activity may result in an increase of about ten per cent in ton-miles in 1943 compared with 1942. The War Production Board has announced a program for part of the coming year which will enable the railroads to purchase 20,000 new freight cars and 386 new locomotives, including both steam and Diesels.

"Capital expenditures in 1942 for equipment, roadway and structures and other improvements to property are estimated at $600,000,000 compared with $543,000,000 in the preceding year.

"Increased traffic as well as larger expenditures for maintenance work resulted in a further increase in employment on the railroads in 1942, the average number of employees having been 1,270,000, or an increase of 11.4 per cent compared with the preceding year. Annual earnings per employee in 1942 averaged $2,285, compared with $2,045 in 1941."

Correction

IN the article describing the Pennsylvania Class T-1 passenger locomotives which appeared in the January issue of the *Railway Mechanical Engineer*, mention was made of the Sellers Type E injector. The correct designation for the Sellers injector used on these locomotives is Type S.

Shippers See First-Quarter Loadings Up 3.4 Per Cent

FREIGHT carloadings in the first quarter of 1943 are expected to be about 3.4 per cent above actual loadings in the same quarter in 1942, according to estimates compiled by the thirteen Shippers' Advisory Boards.

On the basis of those estimates, loadings of the 28 principal commodities will be 7,712,290 cars in the first quarter of 1943, compared with 7,461,503 actual carloadings for the same commodities in the corresponding period in the preceding year. Eight of the 13 Boards estimate an increase in first-quarter loadings, but five (the Pacific Northwest, the trans-Missouri-Kansas, the Southeast, the Atlantic States and the New England Boards) estimate decreases.

(Continued on next left-hand page)

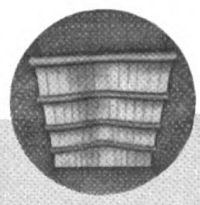
TO HELP AMERICAN RAILROADS DO AN EVEN BETTER JOB



The continuous, uninterrupted movement of the tremendously-increased tonnages incident to our war effort calls for the fullest use of every steam locomotive.

One way to increase the availability of your power is through the application of Security Circulators to your existing locomotives. By so doing you obtain:

1. **Improved brick arch support for all locomotive fire boxes.**
2. **Improved circulation in side water legs.**
3. **Reduced flue plugging, cinder cutting and honeycombing.**



AMERICAN ARCH COMPANY, INC.

60 East 42nd Street, New York, N. Y.

SECURITY CIRCULATOR DIVISION

Supply Trade Notes

AMERICAN STEEL FOUNDRIES COMPANY.—*P. J. Sullivan* has been appointed sales agent of the American Steel Foundries, Chicago, with headquarters at St. Louis, Mo. Mr. Sullivan entered the employ of the traffic department of this company at



P. J. Sullivan

Chicago on November 25, 1905, and was later appointed assistant chief clerk in the order department. On December 13, 1921, he was promoted to manager of the order department, which position he was holding at the time of his transfer to St. Louis.

E. J. McQuaid succeeds Mr. Sullivan as manager of the order department. Mr. McQuaid was born in New York. He en-



E. J. McQuaid

tered the employ of the American Steel Foundries on April 6, 1920, and on June 1, 1942, was appointed assistant manager of the order department.

◆

STANDARD RAILWAY EQUIPMENT MANUFACTURING CO.—*A. A. Frank,* executive vice-president of the Standard Railway Equipment Manufacturing Co., Chicago, has been elected president to succeed Walter P. Murphy, whose death on December 16 was reported in the January issue. At the same time Mr. Frank succeeds Mr. Murphy as president of the Standard Railway Devices Company, of which he was vice-president; The Standard Railway Equipment Manufacturing Co. (Canada), Ltd., of which he was executive vice-president; and the Railway Metal Products Company. Mr. Frank will continue as president of the Standard Railway Equipment Company. He takes over his additional duties with a background of mechanical experience in actual railroad operation and long experience in the merchandising of products for railway use. After attending grammar school, he studied mechanical engineering and contract law. He entered railway service as a clerk in the transportation department of the Missouri Pacific, and after serving as a car distributor and as chief clerk, transferred to the mechanical department, where he worked as statistician and chief clerk. On April 14, 1911, he resigned to become secretary to Mr. Peter H. Murphy, who was then president of the P. H. Murphy Company (now part of the Standard Railway Equipment Manufacturing Company) and in 1913 was appointed manager of the company's plant at New Kensington, Pa. For three years, 1915-1917, he was sales agent of the Standard Railway Equipment Company at St. Louis, Mo., and in 1918 was elected vice-president in charge of sales of this company at Chicago. In January, 1921, he was elected president of this company and also



Arthur A. Frank

vice-president of the Union Metal Products Company (now a part of the Standard Railway Equipment Manufacturing Company). On January 1, 1939, Mr. Frank was also elected executive vice-president of the Standard Railway Equipment Manufacturing Company, Chicago, and on December 22, 1942, was elected president.

◆

WYANDOTTE CHEMICALS CORPORATION.—The J. B. Ford Company and Michigan Alkali Company, its affiliate, have consolidated as one company known as Wyandotte Chemicals Corporation. *E. M. Ford,* formerly a director of the J. B. Ford Company, is president of the new corporation. The sales departments of both companies will temporarily maintain their separate identities as divisions of Wyandotte Chemicals Corporation. *C. B. Robinson,* vice-president in charge of sales of the J. B. Ford division, will continue to promote the sale of Wyandotte cleanser to railroads and other industries not specifically assigned to the Michigan Alkali Division. The



C. B. Robinson

Michigan Alkali Division, of which *Bert Creamers* is vice-president in charge of sales, will handle, in addition to war production, sales in other industries such as aluminum, glass, etc., as well as railway sales.

◆

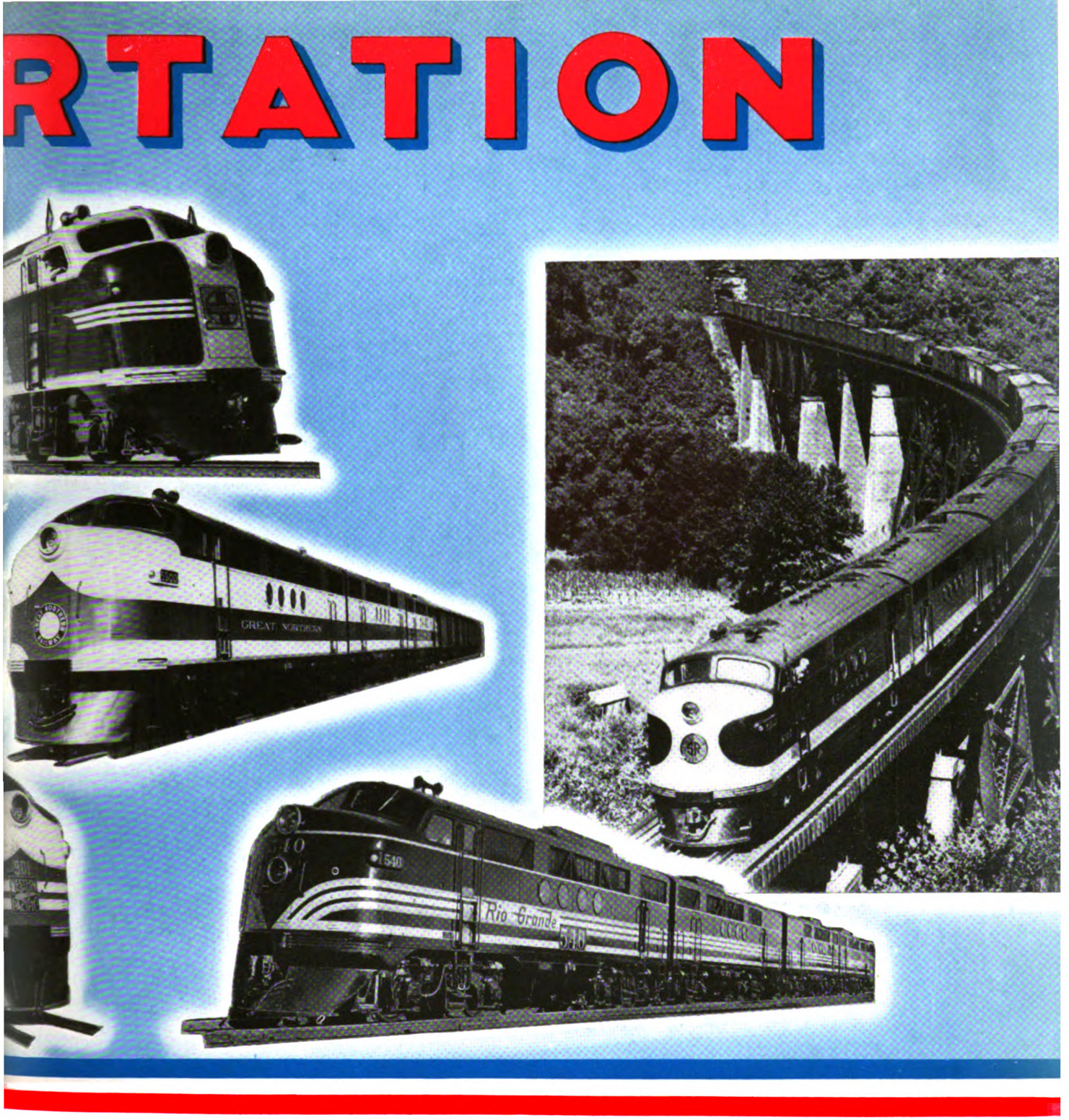
NATIONAL MALLEABLE & STEEL CASTINGS COMPANY.—*Wilson H. Moriarty* has been promoted to the position of assistant to the president, as announced in the January issue. Mr. Moriarty was graduated from the Case School in 1918 and served as an officer in the heavy artillery during the first world war. After a training period he became resident inspector at National Malleable's Cleveland, Ohio, plant and later held



Wilson H. Moriarty

similar positions in the East St. Louis, Mo., and Chicago plants. In 1927 he was appointed chief inspector for all of the company's plants. Three years later he was appointed sales engineer at the Cleveland plant, and in 1939 became that plant's sales manager. He was promoted to the position of assistant to the first vice-president in June.

(*Continued on second left-hand page*)



GM DIESELS MEET THE CHALLENGE

TO "Keep 'em Rolling" in 1943, railway motive power will have to keep step with the ever-increasing war-time traffic. To meet this demand, existing locomotives must be kept in maximum repair and new locomotives will be provided as authorized by the War Production Board. In the selection of new power, maximum performance and economy and minimum use of critical materials are of major importance. General Motors Diesel Road Locomotives make possible greater hauling capacity — reduction in train miles as much as 50 percent — faster schedules — greater availability — release for other important services as many as five heavy steam locomotives for each Diesel locomotive operated — increased carrying capacity of existing track facilities resulting in less wear and tear on rail and bridge structures. And in the *conservation of vital materials*, one ton of materials in a GM Diesel locomotive will do the work of more than two tons of materials in a steam locomotive.

THE AMERICAN WAY WILL WIN

GENERAL MOTORS
LOCOMOTIVES

1942. Mr. Moriarty has been instrumental in developing and perfecting several types of malleable iron and steel castings now used in war production.

Walton L. Woody, the newly appointed assistant to the president in charge of the Sharon, Pa., and Melrose Park, Ill., steel



Walton L. Woody

castings plants, joined National Malleable's Indianapolis, Ind., plant in 1914, immediately after graduation from the Rose Polytechnic Institute, Terre Haute, Ind. He was transferred to Cleveland in the same year and established the company's first chemical laboratory. He later became metallurgist and assistant superintendent in Cleveland, and in 1925 was appointed plant manager. In 1926 he acted as manager of the Chicago plant, returning to Cleveland later in the same year, where he remained until 1938, when he became plant manager at Sharon. Mr. Woody directed the modernization of the Cleveland, Sharon and Melrose Park plants. Under his direction the Sharon and Melrose Park plants are now completing expansion programs to take care of steel castings for tanks and anchor chain for the U. S. Navy, in addition to their usual railroad work. Several years ago he perfected for industrial use the triplex and duplex methods of melting malleable iron. Mr. Woody is a director of the American Foundrymen's Assn.

WAUGH EQUIPMENT COMPANY.—*Samuel Berman*, electrical test engineer of the New York independent subway system and inventor of the Berman Metal Locator, has joined the Waugh Laboratories, a division of the Waugh Equipment Company, where he will specialize on electronic work. Mr. Berman is the inventor of the electro-magnetic foreign body finder which helped to save many of the lives of men wounded at Pearl Harbor by promptly locating shell and bomb fragments so that they could be removed. The Locator is now in production at the Waugh Laboratories.

Obituary

CHARLES A. KROPP, chairman of the board of the Kropp Forge Company and the Kropp Forge Aviation Company, Chicago, died on December 17 at his winter home at Miami Beach, Fla. Mr. Kropp was born at Annefors Bruk, Sweden, on June 26, 1865, and migrated to the United States in the late 80's. The present Kropp



Charles A. Kropp

Forge Company had its roots in the water-powered forge shop founded by Mr. Kropp's father in 1837 at Annefors, Sweden, where C. A. Kropp learned his trade. In 1901, Mr. Kropp organized one of Chicago's earliest job forging shops, the Sundberg-Kropp Company, from which the present Kropp Forge Company and subsidiaries have evolved. Mr. Kropp had been inactive the last several years, spending most of his time at his Florida and Round Lake, Ill., homes.

◆

JOHN S. Y. FRALICH, district engineer for the Westinghouse Air Brake Company, with headquarters at Chicago, died January 5. Mr. Fralich served his apprentice-



John S. Y. Fralich

ship in the Pennsylvania's shops at Altoona, Pa., and was in service there for two years as a machinist. He entered the employ of the Westinghouse Air Brake Company as a machinist in 1904, and subsequently became supervisor of shop tests under the direction of the engineering department. For many years he assisted in the development, testing and road service trials of new air brake apparatus while associated with the experimental division of the engineering department and as assistant to the mechanical engineer. He was transferred to the Chicago office in 1913, as assistant resident engineer, and in 1919 was appointed district engineer. Mr. Fralich was a member of the Central Air Brake Club, the Western Railway Club, and the American Society of Mechanical Engineers.

Personal Mention

General

A. H. OSTBERG, mechanical inspector, Lines East of the Missouri river, of the Chicago, Burlington & Quincy, has been appointed general mechanical inspector, Lines East, with headquarters as before at Chicago.

Master Mechanics and Road Foremen

W. S. RICH, assistant master mechanic of the Boston & Albany at Beacon Park, Allston, Mass., has been transferred to West Springfield, Mass.

C. F. BARNHILL, master mechanic of the Gulf division of the Gulf, Colorado & Santa Fe, retired on January 1.

J. D. NIMMO, general foreman of the Gulf, Colorado & Santa Fe at Cleburne, Tex., has been appointed master mechanic of the Gulf division with headquarters at Silsbee, Tex.

J. R. KEELEY, general foreman of the Virginian, with headquarters at Roanoke, Va., has been appointed acting master mechanic at Victoria, Va.

F. J. CARTY, master mechanic of the Boston & Albany at South Station, Boston, Mass., has been transferred to Beacon Park, Allston, Mass.

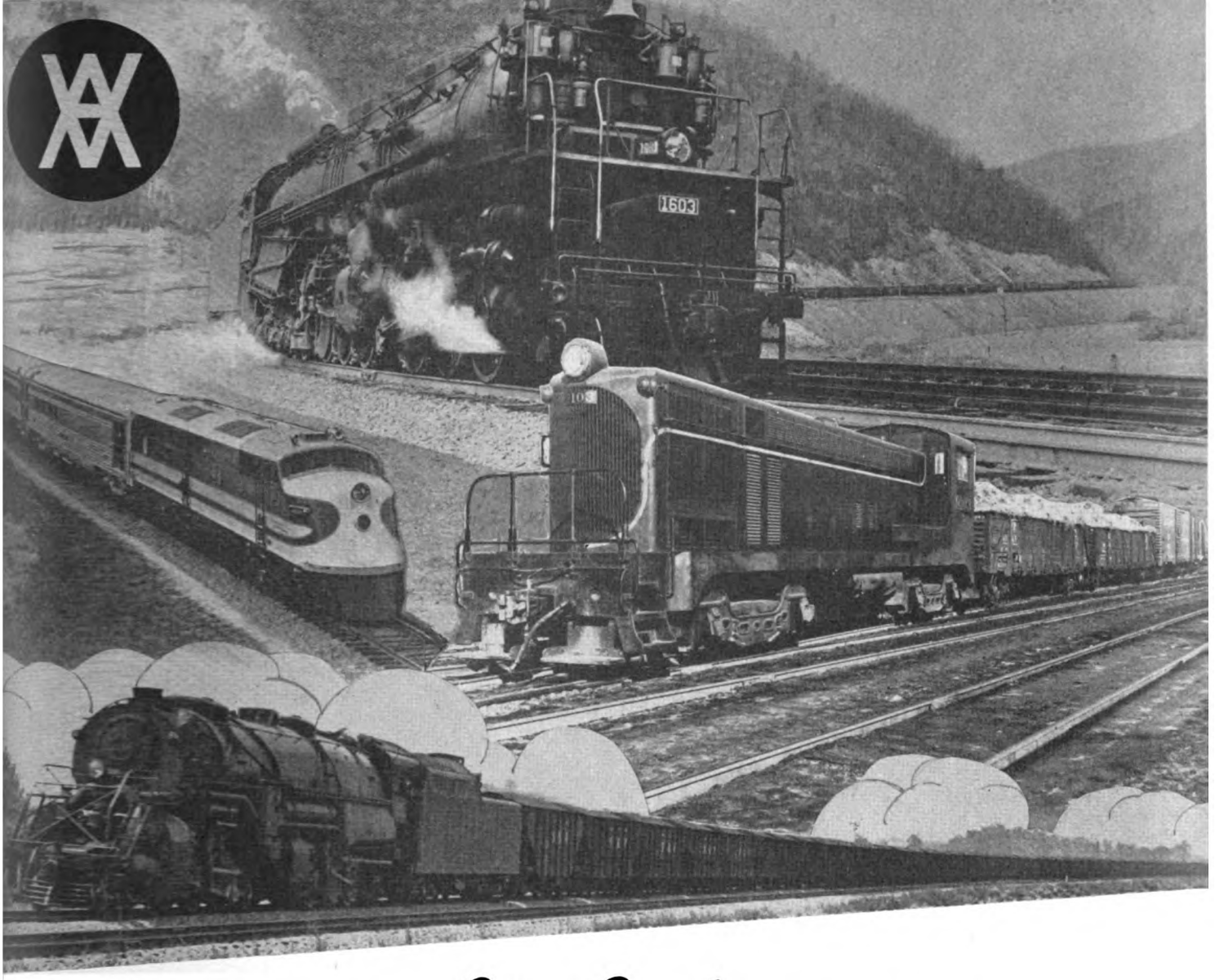
R. REYMOND has been appointed road foreman of engines of the London division of the Canadian National, with headquarters at Mimico, Ont.

W. G. GRAY, master mechanic of the Virginian at Victoria, Va., has been transferred to Elmore, W. Va.

A. H. RIEGER, road foreman of engines of the Quebec district of the Canadian National, has been transferred to the Montreal district, with headquarters at Joliette, Que.

P. M. ROOKER has been appointed road foreman of engines, Wilmington district of the Atlantic Coast Line.

(*Continued on next left-hand page*)



MODERN *Air Brakes* help Secure the MOST from Available Facilities

Smooth train handling — higher operating speeds in safety — adequate control for heavy tonnage trains — maximum flexibility for quick terminal shifting — reliable performance under rigorous duty — durability for long time service. These advantages accruing from the use of modern air brakes, adapted for specific requirements on various types of equipment, are helping to expedite volume shipments of vital wartime materials and supplies ★ Moreover, they will be an accumulating asset for peacetime transportation as an increasing proportion of locomotives and cars become equipped with this up-to-date apparatus. Now the demand is for quantity, time-saving, and continuity. Then, operating economy may be a major requirement, and you'll need the most of the best.

WESTINGHOUSE AIR BRAKE CO.
Wilmerding, Penna.

C. R. PATTERSON has been appointed road foreman of engines of the Canadian National of the Belleville division, with headquarters at Lindsay, Ont.

Car Department

J. D. REZNER, whose promotion to the position of superintendent of the car department of the Chicago, Burlington & Quincy with headquarters at Chicago as announced in the January issue, was born at Kirkwood, Ill., on July 13, 1893, and entered railway service on the Burlington in 1913 as an agent's helper at Kirkwood. In 1914 he became a car repairer at Alliance, Neb., and later served as a coach repairer and inspector at Omaha, Neb.; night foreman of train yard inspectors at McCook, Neb., and day foreman of train yard inspectors at Alliance. In February, 1919, he became assistant car foreman at Alliance and seven months later was promoted to the position of assistant general car foreman at Lincoln, Neb. Mr. Rezner was appointed assistant general car inspector of the



J. D. Rezner

Lines West of the Missouri river, with headquarters at Lincoln, in June, 1922, and in 1927, general car inspector, Lines East, with headquarters at Chicago. In January, 1931, he was transferred to the Lines West, with headquarters at Lincoln, and in September, 1937, he was appointed superintendent of shops at Havelock, Neb. Mr. Rezner was appointed general car foreman at Chicago in October, 1938, in which position he remained until his appointment as superintendent.

Purchasing and Stores

CHARLES C. HUBBELL, general purchasing agent of the Delaware, Lackawanna & Western at New York, who retired on January 1, as announced in the January issue, was born on March 1, 1870, at Columbus, Miss., and was educated at the Peekskill Military Academy. He entered railroad service in 1895 as a cashier in the employ of the New York & New Jersey Ferry Co. (now owned by D. L. & W.), and in 1898 became treasurer of the New York & Hoboken Ferry Co. (now owned by D. L. & W.). In 1903 he went with the Delaware, Lackawanna & Western as auditor of miscellaneous receipts. In 1909 he was appointed auditor of disbursements;



Charles C. Hubbell

in 1910, purchasing agent at New York, and in 1935 general purchasing agent at New York.

RUSSELL E. KING, assistant to the general purchasing agent of the Delaware, Lackawanna & Western, has been appointed to the position of purchasing agent at New York.

Obituary

WILLIAM JACOB, mechanical engineer of the Pere Marquette at Detroit, Mich., died on January 6 after a long illness. Mr. Jacob was 60 years old.

T. HAMILTON, former engineer of motive power of the Pennsylvania at Philadelphia, Pa., who retired from that position in 1938, died on December 26, at his home at Chambersburg, Pa. He was 66 years old.

OTTO JABELMANN, vice-president in charge of research and mechanical standards of the Union Pacific at Omaha, Neb.,



Otto Jabelmann

died on January 6 in London, England, while he was on a special mission abroad in connection with lease-lend distribution. Mr. Jabelmann had journeyed to England at the request of W. A. Harriman, lease-lend expediter, who accompanied him. Mr. Jabelmann was born at Cheyenne, Wyo., on July 24, 1890, and entered railway service as a call boy for the Union Pacific on September 22, 1906. He has been continuously in the service of the Union Pacific since that time, with the exception of three years during which he attended the University of Michigan and a period from May to August, 1917, when he was a machinist on the Southern Pacific at San Francisco. He advanced through the mechanical department, serving successively as apprentice, machinist helper; machinist and assistant enginehouse foreman at Cheyenne; general foreman at Laramie, Wyo.; machinist at North Platte, Neb.; enginehouse foreman, district foreman, and superintendent of shops at Cheyenne. On January 1, 1929, he was transferred to Omaha as superintendent of shops and in October, 1933, became general superintendent of motive power and machinery at Omaha. He was appointed assistant to the president in charge of research in November, 1937, and in June, 1939, was elected vice-president in charge of research and mechanical standards.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

TURRET LATHES.—International Machine Tool Corporation, Foster Division, Elkhart, Ind. Sixteen-page illustrated bulletin descriptive of Foster No. 5 Universal ram type turret lathes.

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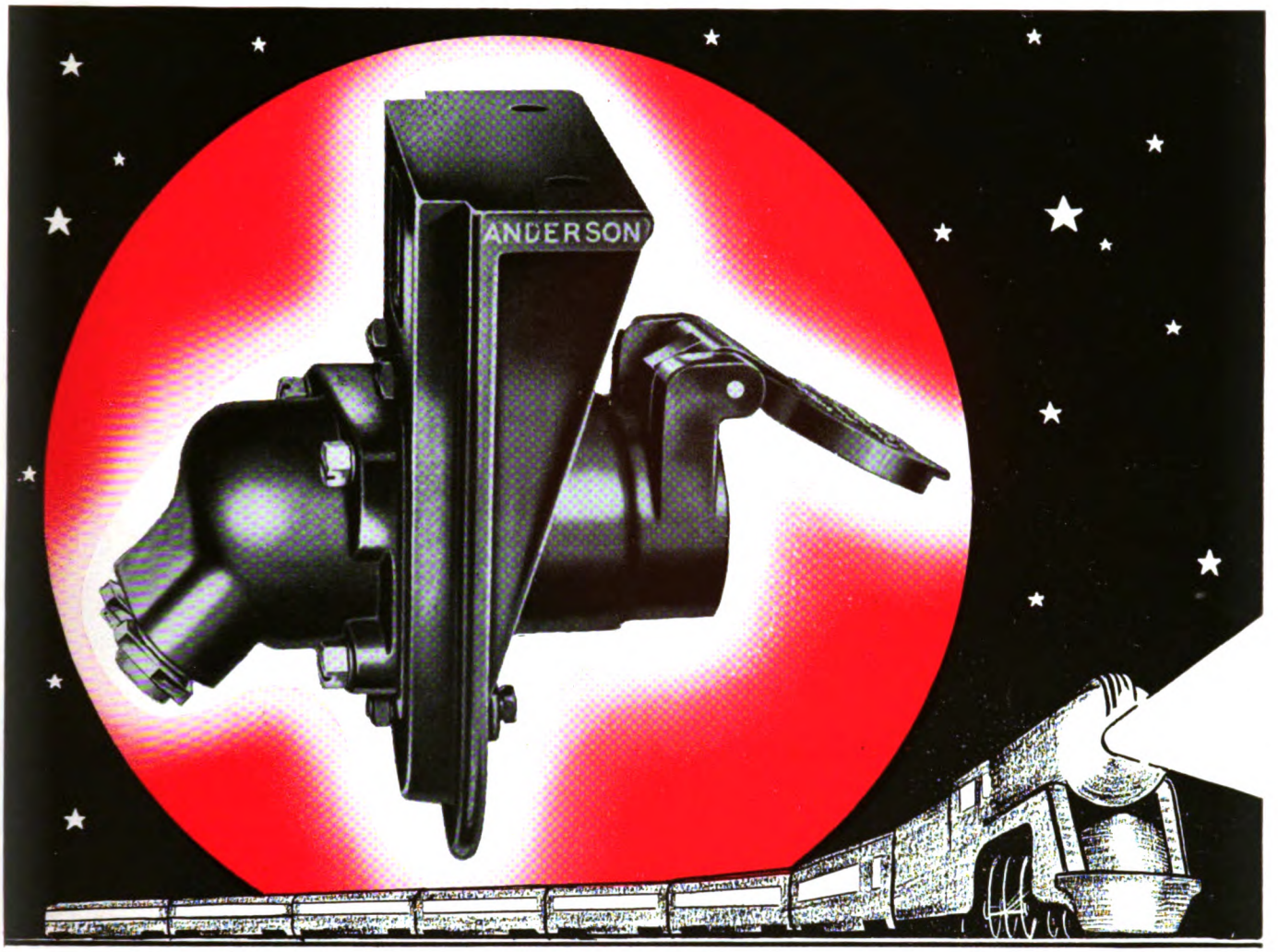
MILLING MACHINES.—Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio. Publication No. 0-8, M-964-1 descriptive of Plain Automatic Milling Machines with or without rise and fall spindle carrier.

◆

TURRET MILLS.—Rogers Machine Works, Inc., 125 Arthur street, Buffalo, N. Y. Twelve-page illustrated catalog of Rogers "Perfect 36" vertical turret mills for boring, drilling and turning, with condensed specifications for standard and high-speed models.

◆

"RAILROAD CLEANING HANDBOOK."—Magnus Chemical Company, Inc., Dept. REE, Garwood, N. J. Twenty-six pages, illustrated. Four sections—Cleaning Problems of: General Repair Shops (cleaning Diesel engine parts, air pumps, vats, and grinding chilled-steel car wheels); Paint Shop (stripping paint from rolling stock); Terminal Yard (cleaning coach exteriors and interiors, upholstery, etc.); Other Railroad Cleaning Problems (radiator and cooling systems, floor and window cleaning, etc.).



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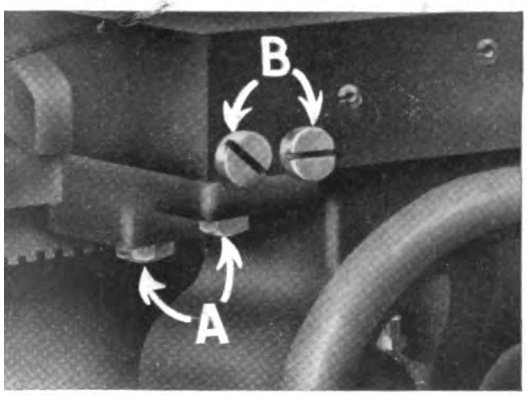
I'm Tellin' You.

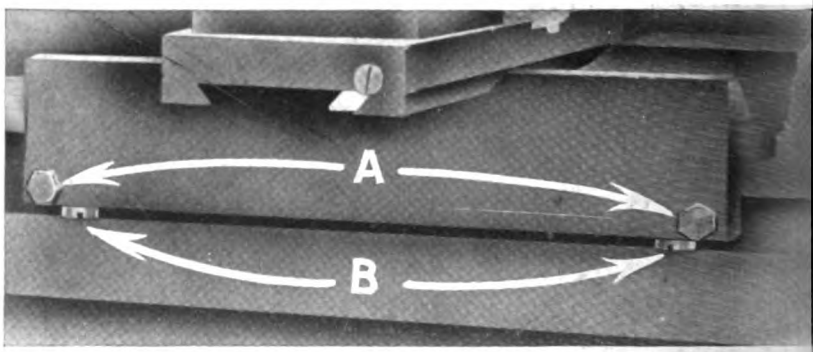
No. 6 in a series of tips on "Keeping 'em Turning"
by Charley Wetterer, 43 years at LeBlond.

"Clean your teeth twice a day and see your dentist twice a year" is a pretty good general rule. Lathe care would be a lot simpler if we could set up some kind of slogan like that for adjustments. But the schedule for lathe adjustment varies greatly with the number of work hours per day, the kind of material machined, regular or intermittent cut, condition of tools used, etc.

However, chatter in the work is a pretty fair sign that adjustments may be needed. The most common source of this kind of trouble is slack in the bearings at these two points. Both are easily fixed.

ADJUSTING CARRIAGE GIBS





Each of the two front gibs on the carriage have a bearing on the side of the Veeway and are held in position by the two cap screws (A). Two adjusting set screws (B) hold the carriage gib firm against the side of the ways. To take up slack caused by wear on the bearings, loosen bottom screws (A), then tighten side screws (B) until you feel slight pressure of gib against the way. Now retighten bottom cap screws.

On the long gib in the rear of the carriage which does most of the work, the position of the cap and adjusting screws (B) are on the bottom. However, the procedure in relation to cap and adjusting screws is the same, i. e., loosen (A), tighten (B), then retighten (A).



ADJUSTING SPINDLE

Wear in anti-friction bearings of the spindle is another cause of vibration of the work on old lathes. Here the adjustment procedure itself is simple, but is different for each type of lathe. For information on eliminating end play or longitudinal movement in your particular lathe, write me for easy instructions.

ARMY E NAVY

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Cincinnati, Ohio
Largest Manufacturer of a Complete Line of Lathes

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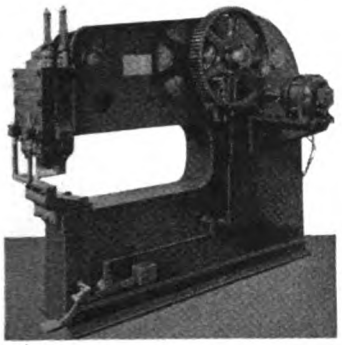
140 CEDAR STREET NEW YORK, N. Y.

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BENDING AND SHAPING MACHINES • SPACING TABLES

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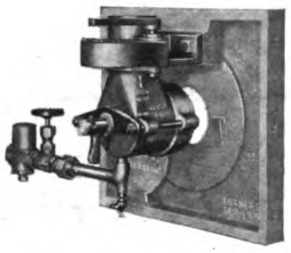
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THE EDITOR'S DESK

YOUR PUBLISHER'S PROBLEMS

Undoubtedly most of our readers are already aware, from announcements made in the newspapers and other magazines, that the publishers will be forced to reduce the amount of paper and other materials that they have been using. This reduction will hit our publication rather hard, because we have for many years exercised unusual care in the control of such items.

Because we are enthusiastic in supporting any measures that will help to win the war, we shall of course gladly accede to these regulations. In so doing, however, we shall make every possible attempt to accomplish the necessary ends without reducing the quality of service to our readers and advertisers.

Rather than cut down the number of pages we shall go to lighter weight paper stock. Beginning with the April issue we shall reduce the trim size of the page; the size of the printed page, however, will remain the same. The effect, no doubt, will be to produce a less pleasing area of white space in which the type page will be framed; it will require no change whatever in the arrangement of the type page.

In the past we have favored the subscribers who were lax in renewing their subscriptions, by extending credit to them until we received definite word as to their intentions. It will be necessary to take somewhat drastic measures in that respect, and if you are careless in renewing your subscription you may miss some of the issues. Frankly, we don't like to take this step, but it is quite necessary if we are to make the necessary savings in paper.

This is a war of production in which the railroads are a most essential element. Publishers of business and technical papers, such as ours, can take considerable pride in the fact that those high in authority in the Administration have recognized the business press as being of greatest value in the emergency, in helping to stimulate greater efficiency and effectiveness in industry and transportation. This appreciation has been voiced in many ways and it has given us confidence to go forward with greater energy and vigor in the attempt to serve our readers and advertisers. We shall do our level best to turn out a creditable magazine and we bespeak your patience in the months to come, if it shows evidences of the effects of war.

We have on the desk before us a number of British papers, including copies of the (London) Railway Gazette. We take off our hats to them for the splendid job that they are doing, under conditions that must be much more severe than any that have been encountered in this country.

Roy V. Wright

RAILWAY MECHANICAL ENGINEER

Founded in 1832 as the American Rail-Road Journal

With which is incorporated the RAILWAY ELECTRICAL ENGINEER.
Name Registered, U. S. Patent Office.

MARCH, 1943

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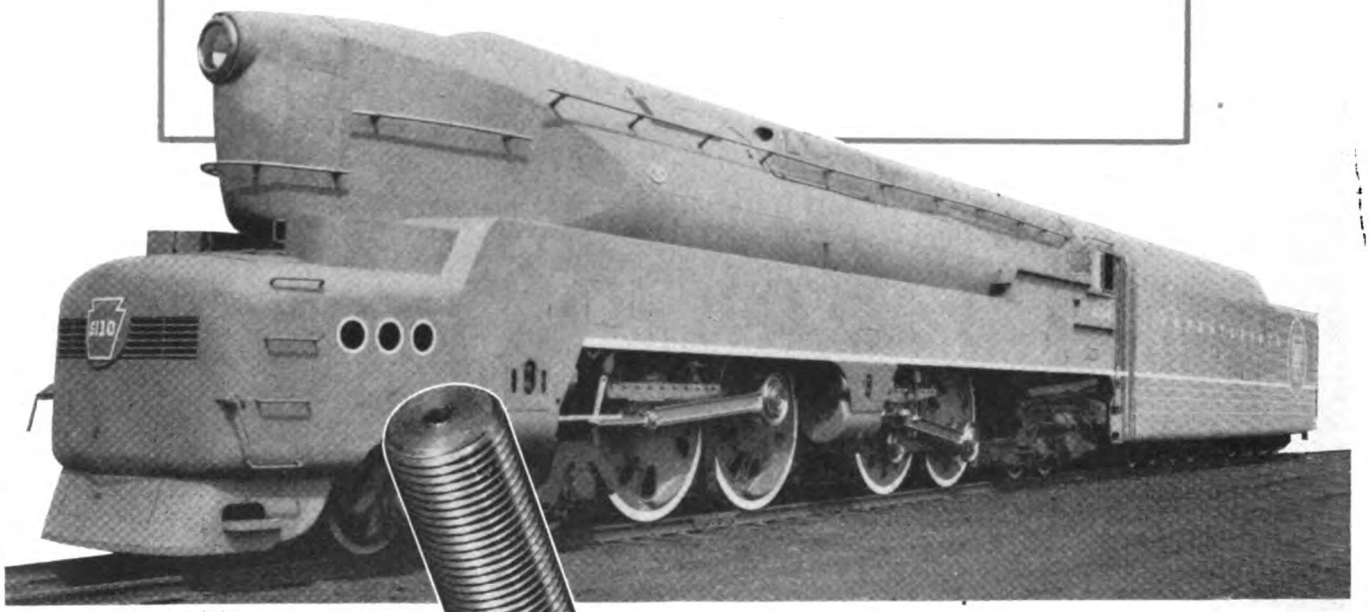
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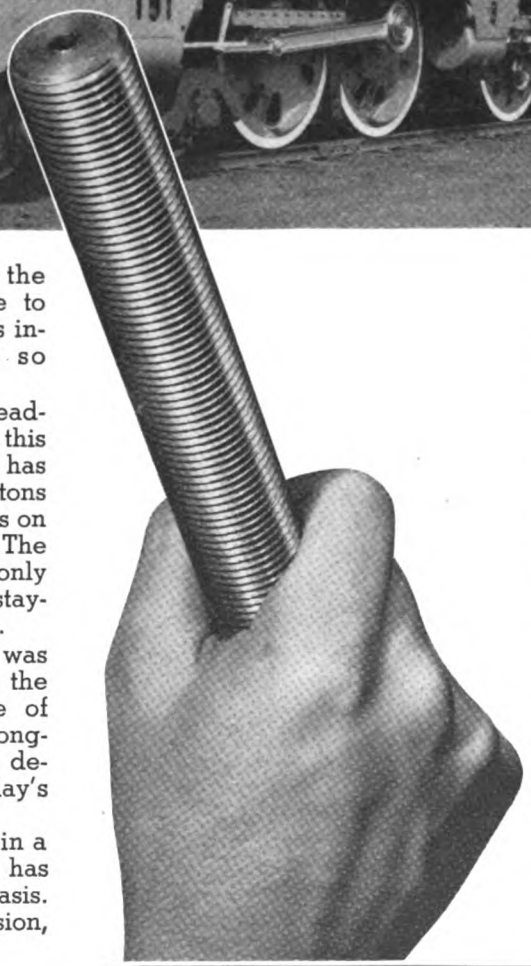
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CARBON STEEL TUBULAR PRODUCTS

Reducing Weight of

Diesel Road Locomotives*

By P. B. Jackson†

Small-bore cylinders, small engine-generator units, higher engine speeds, and extensive use of aluminum are proposed

In the speed range above 20 m.p.h. the available tractive force of a road locomotive, for either freight or passenger service, is limited to the power developed by the Diesel engines. This is not sufficient to produce maximum tractive force in the high-speed range. Maximum tractive force for any locomotive can be attained by making all axles driving axles, but the weight of present Diesel road locomotives make this impractical and, in fact, of little advantage in the overall performance of the unit. In spite of the possibilities of large weight saving it is doubtful if a road locomotive will ever be light enough to make its starting and low-speed performance unsatisfactory.

In Table I are set forth some of the characteristics of two locomotives. Locomotive *A* is an existing unit of 6,000 hp. Locomotive *B* is a unit intended for the same service and to give approximately the same performance. The two outstanding differences are a reduction of weight of 275,000 lb. and a reduction in horsepower of 750. Further reference to this table will be made after comparisons of the performance curves are completed.

Fig. 1 shows a series of curves that compare several performance factors of the two locomotives whose characteristics are outlined in the table. Curves 1 and 2 are the available tractive force of locomotives *A* and *B*, respectively. Numbers 3 and 4 are resistance curves of each locomotive plus a trailing load of 15 cars weighing 66 tons each. It will be noted that these cross at 100 m.p.h. for the *A* powered train and 97.5 m.p.h. for the

* Abstract of a paper presented before a joint session of the Oil and Gas Power and Railroad divisions at the annual meeting of the American Society of Mechanical Engineers, December 2, 1942.

† Mr. Jackson is with the Aluminum Company of America.

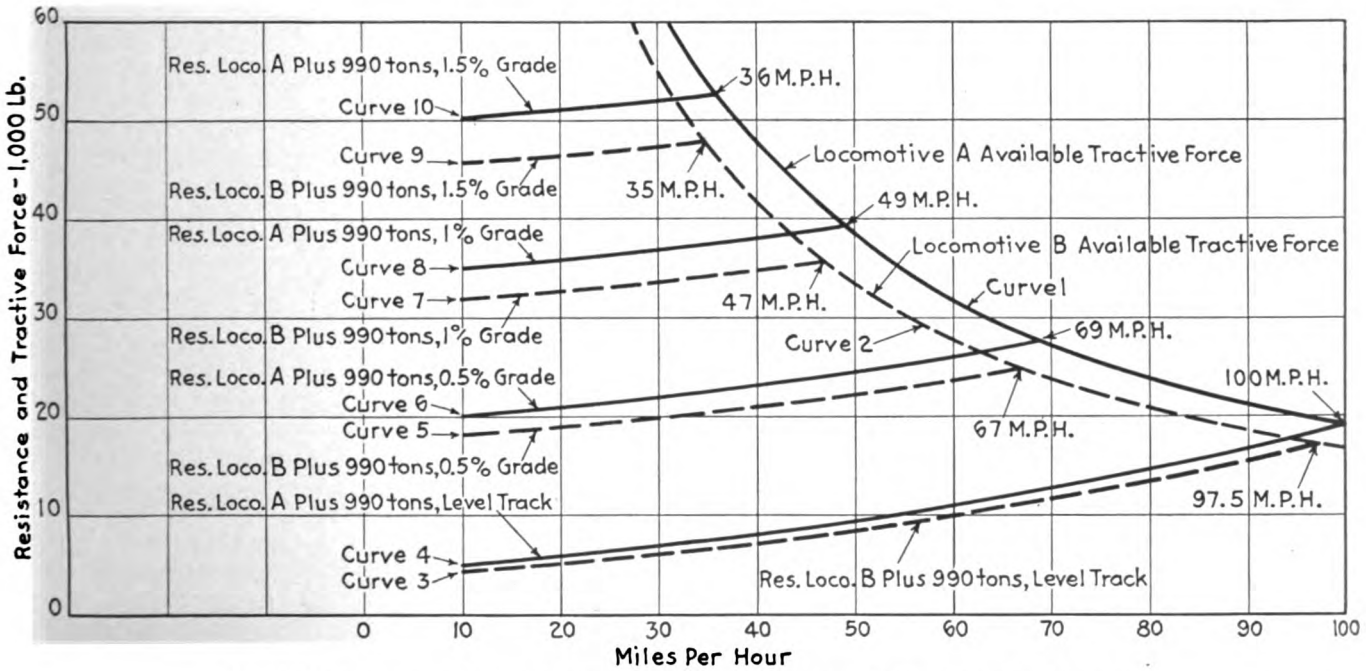
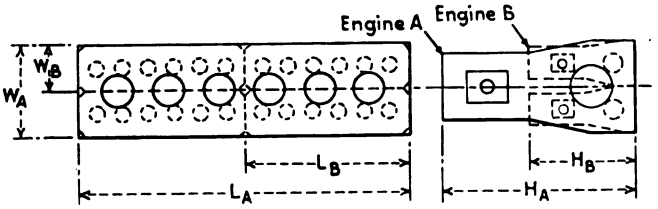


Fig. 1—Resistance and tractive-force curves of the locomotives in Table 1 plus 15 66-ton cars

B powered train. These maximum speeds are for equal trailing or revenue producing capacity. The *B* unit is 750 hp. less than the *A* unit, and obviously is the more economical to operate. The difference in maximum speed of the two trains, both on level track as well as on grades, are so small that differences in the mechanical, electrical, or track conditions would produce performance variations of greater magnitude than are indicated by these curves.

Curves Nos. 5 to 10, inclusive, Fig. 1, indicate the total train resistances on ½, 1 and 1½-per cent grades. They illustrate the value in weight reduction in the locomotive, particularly at speeds below 70 m.p.h.

The table shows some of the economies which may be realized in the operation of a light road locomotive. The fuel saved per year, on the basis of a 60 per cent



	Engine *A*	Engine *B*	Combined small engines
Number of cylinders	6	6	24
Horsepower	4	1	4
Bore	2	1	1
Stroke	2	1	1
R. p. m.	1	2	2
Piston speed	1	1	1
Mean effective pressure	1	1	1
Compactness factor	8	1	4
Weight factor	8	1	4

Compactness factor — (constant) HWL
Weight factor = (Constant) (Compactness factor)

Fig. 2—Comparison of compactness and weights of Diesel engines with large and small cylinders

load factor and 6,000 hrs. a year operation, amounts to 145,000 gals. With a lubricating-oil consumption of 3,000-hp. hrs. per gal. under like operation a saving of 900 gals. per year could be expected.

The first cost of the light locomotive is difficult to estimate until more detailed specifications and designs are completed. The notations in the table relating to first cost are estimates only but can be rationalized for the purpose intended. They are based on the assumption that the cost of locomotive *A* bears a definite relation to its horsepower and that locomotive *B* costs will be in close agreement except where materials used to save weight cost more than the materials replaced. In this analysis, some 48,000 lb. were saved by replacing materials now used with aluminum. At a cost of 40 cents per pound saved, which is a very conservative figure, the weight reduction would add $19,200 to the cost of the *B* locomotive. The total cost of locomotive *A* is about 10 per cent higher than the *B* unit.

Because no unusual engineering has been proposed for locomotive *B*, maintenance cost should be no higher than existing equipment and might well be lower because of the fewer axles and lighter axle loads. The use of an increased number of engines should lead to maintenance procedure that could easily result in lower costs and greater availability.

Small Bore Engines

Many developments in the Diesel industry have been made in the past few years that have contributed to more compact and lighter engine designs. Engines of 10 lb. per hp. are available at conservative rating and are as long lived and reliable as their earlier predecessors. Three major developments are responsible, each contributing to the greater compactness and lighter weight. Each of these developments will be discussed briefly and are: (1) the practicability of small cylinder sizes, resulting from advances in injection equipment; (2) supercharging, allowing for higher safe engine rating; (3) materials relatively new in Diesel construction.

The combustion characteristics of Diesel engines are easier to control in large cylinder sizes because of the greater distances available for fuel penetration and larger quantities of fuel handled per cycle. Developments in injection equipment have made possible excellent combustion characteristics in small cylinders without the necessity of providing pre-combustion chambers which are prevalent in the automotive engine designs.

Engine dimensions for any given standard of design vary directly with the bore. In other words, the overall lineal dimensions are reduced directly with the bore. Fig. 2 shows these relations in a comparison between engines with bores in the ratio of 2:1. Specifically stated, a single 1,000-hp. engine will weigh twice as much as four 250-hp. engines having a bore one-half that of the large engine. The space occupied by the four smaller engines will be half that of the single large unit. These reductions have been made without change in the engine rating, materials of construction, or design standards such as unit bearing pressures, cylinder centers, and bore-stroke ratios which are the major factors contributing to reliability and long engine life.

Supercharging

Supercharging has increased engine ratings materially and has also made small cylinder sizes more practical because of the larger quantities of fuel supplied per cycle. Increases in both piston speed and mean effective pressure become mechanical and thermal problems rather than volumetric problems which limit the output of naturally aspirated engines. Changes in engine rating have a direct influence on specific engine weight and

Table I—A Study of Weight-Saving Possibilities in the Diesel Locomotive

	Locomotive A	Locomotive B	Saving
Weight, lb.	1,035,000	760,000	275,000
Horsepower	6,000	5,250	....
Number of axles	18	14	....
Number of engine cylinders	36	120 or 128	....
Weight of Diesel engines, lb.	198,000	52,500	145,500
Weight of Diesel engines per hp., lb.	33	10	....
Weight of electrical equipment, lb.	190,000	166,000	24,000
Weight of electrical equipment per hp., lb.	31.7	31.7	....
Weight of mechanical equipment, lb.	600,000	540,500	59,500
Weight of mechanical equipment per hp., lb.	100	102.75*	....
Weight of lubricating oil, fuel, and water, lb.	47,000	41,000	6,000
Weight saved by eliminating one four-wheel truck, lb.	....	....	26,000
Weight saved by the use of aluminum tanks for oil, fuel and water, lb.	....	....	5,250
Weight saved by the use of aluminum for locomotive cab, lb.	....	....	8,750
Weight saved by the use of aluminum in the Diesel engine, lb.	....	....	34,125
Total weight saved by the use of aluminum, lb.	....	....	48,125
Maximum speed, m. p. h., with 15 66-ton cars:			
On level track	100	97.5	....
On 0.3 per cent grade	69	67.0	....
On 1 per cent grade	49	47.0	....
Fuel oil saved per year, gals.	....	....	145,000
Lubrication oil saved per year, gals.	....	....	900
Cost of locomotive at $100 per hp.	$600,000	$525,000	....
Cost of saving 48,125 lb. at 40 cents per lb.	....	19,250	....
Total cost of locomotives	$600,000	$544,250	$55,750

* This increase is to make allowance for parts such as car heating equipment, and controls which are common to both locomotives and cannot be reduced in weight on the basis of horsepower.

specific compactness. An increase in both mean effective pressure and piston speed of 18 per cent result in weight and space saving in the order of 40 per cent.

Many, if not all, of the thermal problems in an internal combustion engine are a function of waste heat to be dissipated per cycle per square inch of combustion-chamber area which includes pistons, cylinder head, valves, and cylinder liner. This heat load becomes a function of cylinder diameter. The small engine in the comparison shown on Fig. 2 will have one-half the specific heat load of the large engine. This provides a large factor of safety if higher mean effective pressures are contemplated and will not become the limiting factor in development in this direction within the range of near future probabilities.

Small Engines More Rigid

Analysis of the dynamic loadings which determine many of the bearing loads shows that they are a function of the square of the cylinder diameter and in the comparison in Fig. 3 is shown a ratio of 1:4 in favor of the small engine. Bearing areas are also in the same ratio so that unit bearing pressures do not change in spite of the higher rotative speed of the small engine. The possibility of further small engine development could well be in the direction of increased speed without fear of reaching an impractical or unsafe operating speed range. It is the dynamic loading of an engine that dictates many of its dimensional characteristics which, in turn, determine the rigidity factors. Fig. 3 also shows a comparison of the rigidity between the same two engines previously discussed. The small engine is inherently twice as rigid as the large engine, other factors being the same.

The advantages of a small engine may be summarized as follows: Engine *B*, compared with engine *A*, both having the same specific output, has: (1) half the specific weight; (2) half the specific bulk; (3) the same general volumetric characteristics; (4) half the specific heat load per cycle; (5) one fourth the dynamic load factor, and (6) twice the inherent rigidity.

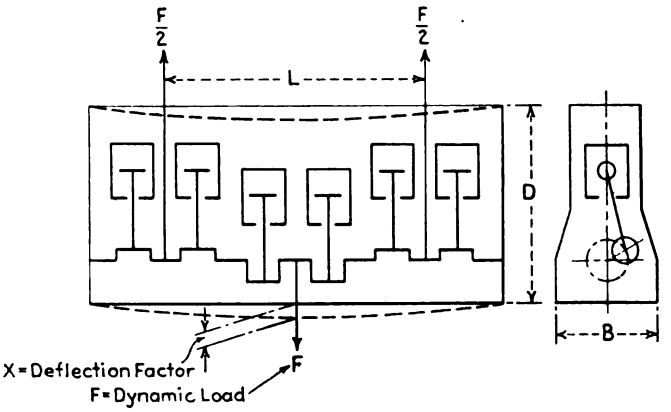
The multiplicity of cylinders appear to be the one major difference that might detract from the comparison of the two engines. This may well be counteracted by the greater basic reliability of the small engines by virtue of lower heat and dynamic load, and deflection factors inherent in the small bore engines. The maintenance problem may well be simpler for the smaller engine because of the reduced weight of all of the engine parts allowing more ease in handling. There is also the possibility of replacing a complete engine generator unit in the event of failure or routine maintenance. A failure of one of the small engines would have far less influence on the locomotive performance than a complete failure of one large engine. Multiplicity of engine cylinders in other internal combustion engine applications have tended to increase reliability.

Where Aluminum Comes In

Aluminum has been extensively used in internal combustion engines for a wide variety of applications. Its characteristics do not, however, lend themselves to all of the parts going to make up a Diesel engine. Crankshafts, camshafts, valves, and cylinder liners are the major items which cannot be made in aluminum. These parts, plus other miscellaneous parts in this same category, however, account for about 25 per cent of the weight of an engine built of cast iron or steel. The cylinder block, crankcase, oil pan, cylinder heads, pistons, gears, gear covers, supercharger housing, manifolds, fuel pump housings, pumps, governor housing, fuel filters, and air filters make up the other 75 per cent of the weight. They can and have all been successfully made in some suitable aluminum alloy. Weight savings from 30 per cent to 70 per cent can be made depending on the function and design characteristics of the particular part. Much experience has shown that an average saving of 50 per cent can be made safely and without compromise to sound design practice. The net result on the total engine weight would be a reduction of 37½ per cent.

The engines for locomotive *B* described earlier in this paper, built of the same materials as engines in the *A* locomotive and with the same piston speed and mean effective pressure weigh 16.5 lb. per hp. Built in aluminum their weight would be 10.3 lb. per hp. This weight so closely approaches the requirement for engine weight set up in the table as to justify its use. Numerous other advantages of aluminum for Diesel engines, all contributing to low specific weight and smaller space requirements could be described but it is beyond the scope of this paper to discuss them. The use of aluminum for the parts proposed is fully justified by operating experience in other applications. They should be carefully engineered for this new application to insure a like satisfactory operating experience.

Referring again to the table, lines 12, 13 and 14 list a total of 40,000 lb. to be saved in parts other than



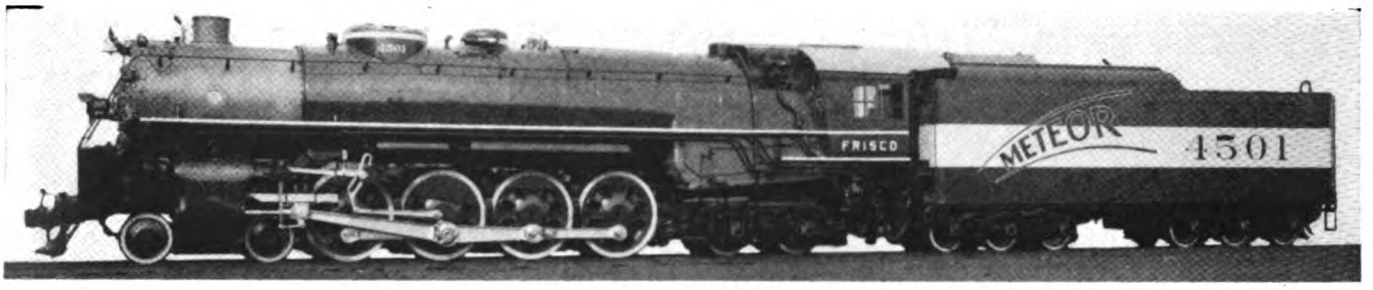
	Engine *A*	Engine *B*
Bore	2	1
R = stroke	2	1
N = r. p. m.	1	2
W = weight of moving parts	8	1
D = height of engine	2	1
B = width of engine	2	1
L = distance between bearings	2	1
F = constant (WRN^2)	4	1
X = constant ($Fl^3 \div BD^3$)	2	1

Dynamic loading and deflections comparison

Fig. 3—Comparison of dynamic loading and deflection

engines. A large part of this weight saving can be made by reducing the number of axles under the locomotive with no increase in load per axle. Locomotive *A* was built with 18 axles with a load of 57,500 lb. per axle. Locomotive *B* because of its reduced weight could have 14 axles loaded to 54,250 lb. per axle. Two of the four axles eliminated are included in the saving listed opposite the item "Weight saved in mechanical equipment." The other two axles eliminated are listed on line 13 as "Weight saved by eliminating one four-wheel truck." The saving is 26,000 lb. which is the estimated weight of this assembly less traction motors. This figure subtracted from the 40,000 lb. listed leaves 14,000 lb. to be saved in the cab, tanks, and electrical and mechanical equipment.

(*Continued on page 119*)



One of the Frisco oil-burning 4-8-4 locomotives for passenger service

Frisco 4-8-4 Locomotives

Fifteen units built by Baldwin include three oil-fired locomotives for passenger service —Tractive force 69,000 lb.

BETWEEN August and October of last year the Baldwin Locomotive Works delivered to the St. Louis-San Francisco a total of 15 locomotives of the 4-8-4 type 12 of which were coal fired freight units and the remaining three were oil-fired passenger locomotives. Except for slight differences necessitated by the two types of fuel used all 15 locomotives are identical in design, the weights also differing slightly. The weights and proportions shown in the table are those of the freight locomotives. The weight on drivers of the oil-burning passenger locomotives is 278,300 lb.; the total engine weight, 454,000 lb. and the weight of the tender is 346,000 lb. All of the locomotives have 74-in. drivers and 69,800-lb. tractive force. The new locomotives are in operation on the Eastern division of the Frisco from St. Louis to Monett, Mo., and over the Southwestern division to Tulsa, Okla. The addition of these locomotives, used in conjunction with heavy Mountain type power previously built, has enabled the road to release a number of Mikados and medium-weight Mountain type locomotives for service on other divisions.

The Boiler and Appurtenances

The boilers are of the conical type, built for a 250-lb. working pressure. The barrel is constructed in three courses the first of which is tapered on top and straight at the bottom. The inside diameters of this course vary from $85\frac{15}{16}$ in. at the front to $89\frac{23}{32}$ in. at the rear. The sheet thickness is $1\frac{1}{32}$ in. The second course is straight on top and tapered at the bottom with the inside diameter varying from $91\frac{25}{32}$ in. to $95\frac{9}{16}$ in. The sheet thickness is $1\frac{3}{32}$ in. The third course is straight, $97\frac{3}{4}$ in. inside diameter, and rolled from $1\frac{1}{8}$ in. plate. The back tube sheet, combustion chamber and outside throat sheets are rolled from $\frac{1}{2}$-in. plate; the crown and furnace door sheets are $\frac{3}{8}$-in. plate and the crown and furnace side sheets are in one piece. The outside throat sheet is 1 in. thick and the back head is $\frac{9}{16}$ in. The firebox roof sheet is $1\frac{1}{8}$ in. thick and this sheet is joined to the lower outside firebox side sheets, $\frac{5}{8}$ in. thick, at a point between the tenth and eleventh rows of staybolts. The front tube sheet, $\frac{5}{8}$ in. thick, is a flat sheet of slightly smaller diameter than the inside of the first course. It is welded to a $\frac{3}{4}$-in. by 4-in. ring which is secured to the barrel by a single row of rivets and seal welded at the top center line.

Welding was used extensively in the construction of these boilers. In addition to the front tube sheet, already mentioned, the back tube sheet is welded to the combustion chamber and the latter to the inside throat sheet. The roof sheet is welded to the lower side sheets; firebox sheets to mudring; crown to door sheet; door sheet to back head in the firedoor opening, and the syphons are welded to the crown and throat sheets.

A complete installation of Flannery flexible staybolts is used in the combustion chamber, throat sheet, the breaking zones of the firebox and in the two outside rows of the back head.

A feature of these boilers is the unusually large radius, 15 in. in the back head corners.

The boilers are arranged for a Coffin Style 4, 63-unit superheater with a dome throttle valve operated by a rod through a back-head stuffing box. A Coffin Type D feedwater heater, together with two Ohio 10,000-gal. live-steam injectors, supply boiler feed water. The boilers have three Nicholson syphons, two in the firebox and one in the combustion chamber and the coal burning locomotives have, in addition, two $3\frac{1}{2}$-in. arch tubes between the syphons and the side sheets. The safety valve equipment consists of four $3\frac{1}{2}$-in. Ashton valves. The boilers are equipped with Signal Foam Meter, TZ blow-off cocks with Okadee separator and muffler. On the coal-burning locomotives Firebar grates, Standard HT stoker and Franklin butterfly firedoor are used.

The Running Gear

The foundation of the locomotive is a General Steel Castings Corporation bed. The cylinders and valve chambers are fitted with bushings of Hunt Spiller iron. The leading and trailer trucks were supplied by the General Steel Castings Corporation. Engine and tender axles are carbon steel and all engine and tender journals are equipped with Hennessy lubricators. The main driving journals are 13 in. by 14 in. and the others are 12 in. by $14\frac{1}{2}$ in. The trailing-truck journals are 9 in. by 14 in. and the engine truck journals are 7 in. by 12 in. Franklin compensators and snubbers are used on all driving wheels and the Alco lateral motion device is applied at the front driver.

The cylinders are 28 in. bore and 31 in. stroke with 14-in. piston valves having 8 in. travel. The valve gear is the Walschaert type controlled by Franklin Type E power reverse gear. The piston rods and crank pins are carbon steel with inside-lubricated hollow-bored main pins. The side and main rods are forged manganese-molybdenum steel with Mangus bushings. The cross-heads are of the multiple bearing type. The driving-wheel centers are the Boxpok type.

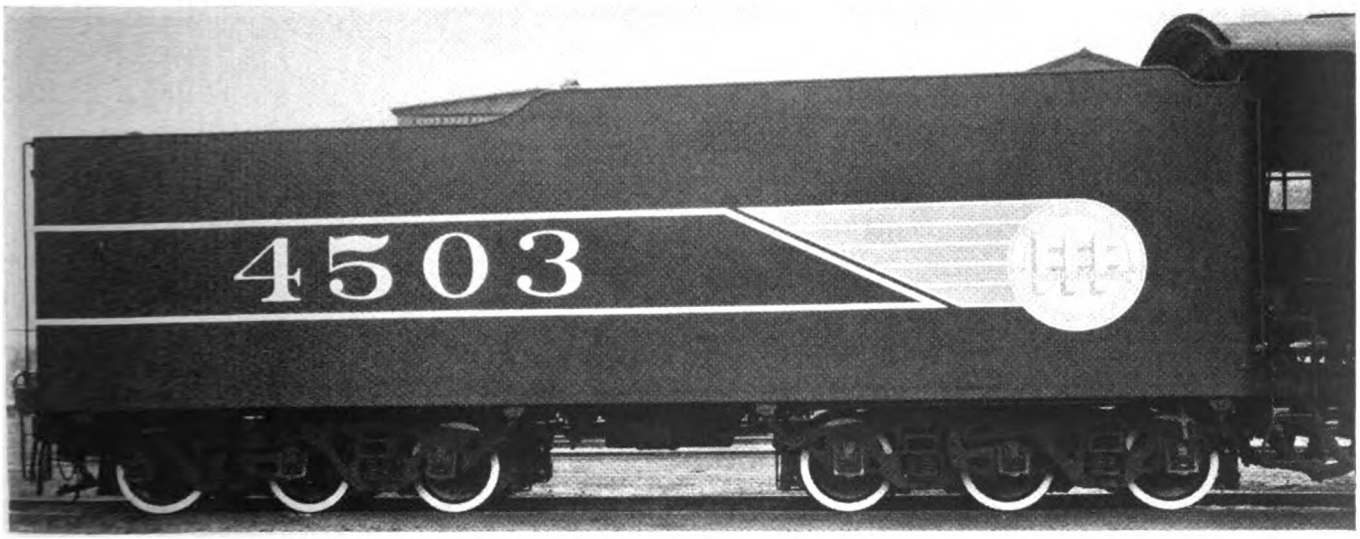
In counterbalancing these locomotives the 2,001 lb. of reciprocating weight on each side is balanced with a 601-lb. overbalanced distributed 100 lb. in the main wheel and 167 lb. in each of the other three drivers. The dynamic augment at diameter speed is 8,300 lb.

Mechanical pressure lubrication for cylinders and valves is supplied by a Nathan DV-5, 26-pint, 5-feed lubricator driven from the valve motion on the right side. Alemite grease lubrication is used at several locations throughout the running gear and Chicago flange oilers complete the equipment. The lubricator feed lines from the Nathan lubricator are ⅜-in. Bundy-weld steel tubing.

General Dimensions, Weights and Proportions of the St. Louis-San Francisco 4-8-4 Locomotives

Railroad	St. Louis-San Francisco
Builder	Baldwin Locomotive Works
Type of Locomotive	4-8-4
Road numbers	4500—4502 Passenger 4503—4514 Freight
Date built	October, 1942
Dimensions:	
Height to top of stack, ft.-in.	16-1
Height to center to boiler, ft.-in.	10-6
Width overall, in.	10-11½
Cylinder centers, in.	94
Weights in working order, lb.:	
On drivers	280,000
On front truck	79,000
On trailing truck	103,500
Total engine	462,500
Tender	275,400
Wheel bases, ft.-in.:	
Driving	19-3
Rigid	12-10
Engine, total	46-6
Engine and tender, total	92-4
Wheels, diameter outside tires, in.:	
Driving	74
Front truck	38
Trailing truck	44
Engine:	
Cylinders, number, diameter and stroke, in.	2—28 x 31
Valve gear, type	Walschaert
Valves, piston, type, size, in.	14
Maximum travel, in.	8
Steam lap, in.	1¾
Exhaust clearance, in.	1⅛
Lead, in.	3/32
Cutoff in full gear, per cent	78
Boiler:	
Type	Conical
Steam pressure, lb. per sq. in.	250
Diameter, first ring, inside, in.	85⅛
Firebox length, in.	132⅛
Firebox width, in.	96¼
Height mud ring to crown sheet, back, in.	84⅜
Height mud ring to crown sheet, front, in.	91¾
Combustion chamber length, in.	77
Arch tubes, number and diameter, in.*	2-3½
Thermic syphons, number	3
Tubes, number and diameter, in.	206-2¼
Flues, number and diameter, in.	63-5½
Length over tube sheets, ft.-in.	20-0
Boiler—(*Continued*)	
Fuel	12 freight—coal 3 passenger—oil
Grate area, sq. ft.	88
Heating surfaces, sq. ft.:	
Firebox and comb. chamber	407
Arch tubes	19.5
Thermic syphons	117.5
Firebox, total	544
Tubes	2,416
Flues	1,806
Evaporative, total	4,766
Superheater	1,508
Combined evap. and superheater	6,274
Tender:	
Type	Rectangular U
Water capacity, gals.	18,000
Fuel capacity, tons	12 coal burners—24 3 oil burners—6,500
Fuel capacity, gal.	
Trucks	6-wheel
Journals, dia. and length, in.	6½ x 12
General data, estimated:	
Rated tractive force, engine, 85 per cent, lb.	69,800
Speed at 1,000 ft. per min. piston speed, m.p.h.	42.6
Piston speed at 10 m.p.h., ft. per min.	234.6
R.p.m. at 10 m.p.h.	45.5
Weight proportions:	
Weight on drivers ÷ weight, engine, per cent	60.6
Weight on drivers ÷ tractive force	4.0
Weight of engine ÷ evaporative heating surface	97.2
Weight of engine ÷ comb. heating surface	73.7
Boiler proportions:	
Firebox heat. surface per cent comb. heat. surface	8.7
Tube-flue heat. surface per cent comb. heat. surface	67.4
Superheater surface per cent comb. heat. surface	24.0
Firebox heat. surface ÷ grate area	6.2
Tube-flue heat. surface ÷ grate area	48.0
Superheater heat. surface ÷ grate area	17.1
Comb. heat. surface ÷ grate area	71.3
Evaporative heat. surface ÷ grate area	54.2
Tractive force ÷ grate area	793.0
Tractive force ÷ evaporative heat. surface	14.6
Tractive force ÷ comb. heat. surface	11.1
Tractive force x diameter drivers ÷ comb. heat. surface	822.0

*On coal-burning locomotives only.



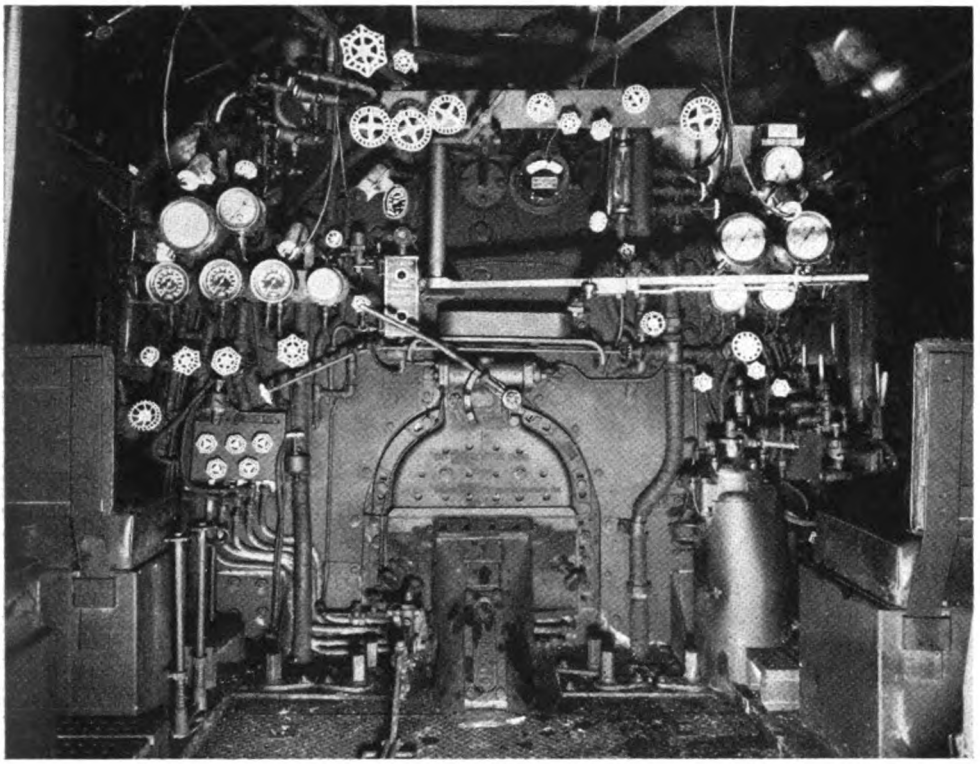
The tender of the coal-burning freight locomotive

The Tenders

The tenders have rectangular tanks of 18,000 gal. water capacity built on Commonwealth cast-steel water-bottom underframes. The tender is mounted on two

Partial List of Materials and Equipment on the St. Louis-San Francisco 4-8-4 Locomotives

Engine bed; engine- and trailing-truck frame	General Steel Castings Corp., Eddystone, Pa.
Driving and trailer wheel tires; springs, driving and trailer	Railway Steel Spring Div., American Locomotive Co., New York.
Flexible air connection between engine and tender	New York Air Brake Co., Watertown N. Y.
Flexible steam connection between engine and tender	Franklin Railway Supply Co., Inc., New York
	Barco Manufacturing Co., Chicago
Rivets	The Champion Rivet Co., Cleveland, Ohio
Signal Foam-Meter	Dearborn Chemical Co., Chicago
Foundation driver brake	American Brake Div., Westinghouse Air Brake Co., Wilmerding, Pa.
Brake shoes	American Brake Shoe & Foundry Co., New York
Locomotive brake equipment; air signal equipment	New York Air Brake Co., Watertown. N. Y.
Rod brasses	Magnus Metal Div., National Lead Co., New York
Lubricators, mechanical	Nathan Manufacturing Co., New York



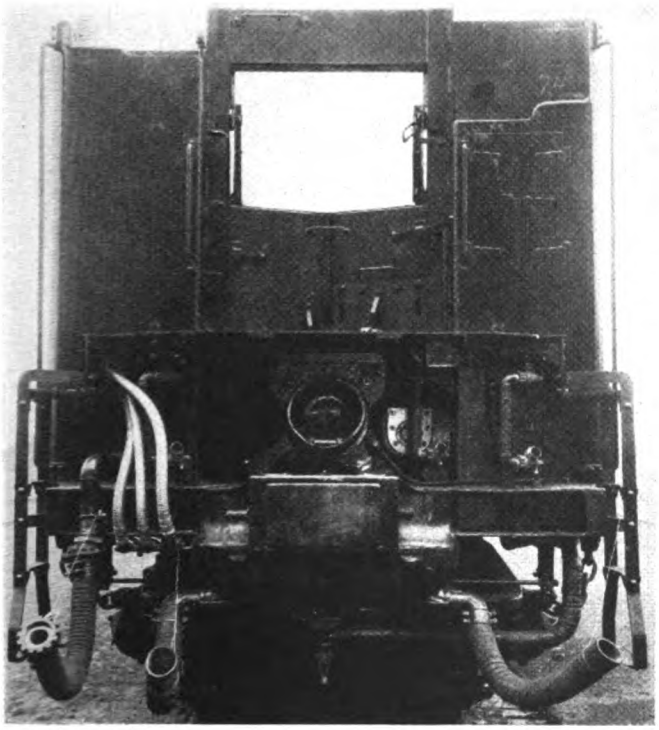
The cab interior of one of the coal-burning locomotives

Lubricators for engine and tender truck boxes and driving boxes	Hennessy Lubricator Company, New York
Axles, engine; crank pins	Standard Steel Works Division of The Baldwin Locomotive Works, Philadelphia, Pa.
Driving and truck box brasses; frame shoes; rod brasses	Magnus Metal Div., National Lead Co., New York
Lateral motion device	American Locomotive Co., New York
Driving-wheel compensators and snubbers	Franklin Railway Supply Co., Inc., New York
Pilot coupler	American Steel Foundries, Chicago
Pilot uncoupling rigging	Standard Railway Equipment Mfg. Co., Chicago
Boiler and firebox steel	Lukens Steel Co., Coatesville, Pa.
Engine-truck wheels	American Rolling Mill Co., Middletown, Ohio
Driving-wheel centers and trailing-centers; safety bar	Standard Steel Works Division of The Baldwin Locomotive Works, Philadelphia, Pa.
Radial buffer, power reverse gear	Franklin Railway Supply Co., Inc., New York
Drawbar, engine and tender	American Steel Foundries, Chicago
Jacket iron	American Rolling Mill Co., Middletown, Ohio
Boiler lagging	Johns-Manville Sales Corp., New York
Staybolt steel	Penn Iron & Steel Co., Creighton, Pa.
Flexible staybolts	Flannery Bolt Co., Bridgeville, Pa.
Tubes and flues	Jones & Laughlin Steel Corp., Pittsburgh, Pa.
	National Tube Co., Pittsburgh, Pa.
Cylinder and valve bushings; valve bull rings; valve packing rings; cylinder packing rings; piston heads	Hunt-Spiller Manufacturing Corporation, Boston, Mass.
Cylinder cocks; piston rod packing; valve stem packing; tank valves	T-Z Railway Equipment Co,, Chicago
Piston rods; main and side rods; crossheads	Standard Steel Works Division of The Baldwin Locomotive Works, Philadelphia, Pa.
Lubricator tubing	Bundy Tubing Co., Detroit, Mich.
Flange lubricator	Ohio Injector Company, Wadsworth, Ohio
Water column	Edna Brass Mfg. Co., Cincinnati, Ohio
Running boards	Alan Wood Steel Co., Conshohocken, Pa.
Valve pilot	Valve Pilot Corporation, New York
Gage cocks	The Prime Manufacturing Co., Milwaukee, Wis.
Blower valve	Locomotive Equipment Division, Manning, Maxwell & Moore, Bridgeport, Conn.
Blower fittings	Barco Manufacturing Co., Chicago
Safety valves	Ashton Valve Co., Boston, Mass.
Steam heat reducing valve	Vapor Car Heating Co., Inc., Chicago
Blow-off valves	T-Z Railway Equipemnt Co., Chicago
Smokebox hinges	The Okadee Company, Chicago
Sander; sander operating valve	Graham-White Sander Corp., Roanoke, Va.
Syphons, firebox	Locomotive Firebox Co., Chicago
Brick arch	American Arch Co., Inc., New York
Superheater	The J. S. Coffin Jr., Company, Englewood, N. J.
Pyrometer	The Superheater Company, New York
Throttle rod packing	The Garlock Packing Company, Palmyra, N. Y.
Piping	National Tube Co., Pittsburgh, Pa.
Pipe covering	Gustin-Bacon Mfg. Co., Kansas City, Mo.
Feedwater heater	The J. S. Coffin Jr., Company, Englewood, N. J.
Injectors; injector checks	Ohio Injector Co., Wadsworth, Ohio
Blowoff muffler and separator	The Okadee Company, Chicago
Washout plugs	The Prime Manufacturing Co., Milwaukee, Wis.
Stoker	Standard Stoker Co., Inc., New York
Firedoor	Franklin Railway Supply Co., Inc., New York
Grates	Waugh Equipment Co., New York
Back pressure gages; steam and air gages	Ashton Valve Co., Boston, Mass.
Bell ringer	Transportation Devices Corp., Indianapolis, Ind.
Whistle	Locomotive Equipment Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Cab lamps; headlight and generator; marker classification and back-up lamps	The Pyle-National Company, Chicago
Cab seat covering	Athol Mfg. Co., Athol, Mass.
Steam-heat connectors	Vapor Car Heating Co., Inc., Chicago
Tender:	
Truck wheels; axles	Standard Steel Works Division of The Baldwin Locomotive Works, Philadelphia, Pa.
Trucks	Buckeye Steel Castings Co., Columbus, Ohio
Frame	General Steel Castings Corp., Eddystone, Pa.
Air brake; air signal	New York Air Brake Co., Watertown, New York
Brake equipment	American Steel Foundries, Chicago
Brake shoes	American Brake Shoe & Foundry Co., N. Y.
Coupler	The Symington-Gould Corp., Rochester, New York
Coupler yoke	National Malleable and Steel Castings Co., Cleveland, Ohio
Uncoupling attachment	Union Metal Products Co., Chicago
Draft gear	W. H. Miner, Inc., Chicago
Coal pusher	Standard Stoker Co., Inc., New York
Safety bars	Standard Steel Works Division of The Baldwin Locomotive Works, Philadelphia, Pa.
Tank valve; washout plug	T-Z Railway Equipment Co., Chicago
Slack adjuster	Royal Railway Improvement Products Corp., Wilmington, Del.

Buckeye six-wheel trucks having 6½-in. by 12-in. journals and 36-in. rolled steel wheels. The feedwater heater is located in the right front leg of the tender tank. The stoker engine is also located on the tender. The coal space is equipped with a Standard Type DA coal pusher.

The tender brake equipment was furnished by American Steel Foundries and the trucks are equipped with



Engine-tender connections on the front end of the tender

two 14-in. by 12-in. brake cylinders. The brake is designed for a braking load of 144,000 lb. (85 per cent of light weight) at 50-lb. cylinder pressure.

Other Locomotive Equipment

The engine brake schedule is No. 8 ET and the equipment was supplied by the New York Air Brake Company. Air is supplied by two 8½-in. cross-compound compressors located on brackets at the front end. The air lines between engine and tender are Goodall semi-metallic with Franklin sleeve-joint connectors for stoker engine and steam-heat lines. Barco flexible connectors are used on the feedwater-heater steam line.

The tender draft gear is the Miner A5XB. Between engine and tender are Franklin Type E-2 radial buffers.

Reducing Weight of Diesel Road Locomotives

(*Continued from page 115*)

Tanks for lube oil, fuel and engine cooling water weigh, when made of steel about two pound per gallon. Aluminum tanks weighing one pound per gallon have given satisfactory service in railroad operation. Diesel road locomotives provide tanks for these supplies with a combined capacity of one gallon per engine horsepower. By making the tanks in aluminum, one pound per gallon could be saved or a total of 5,250 lb. for the 5,250-hp. *B* locomotive.

The aluminum sheet, structural shapes and deck used on the Pennsylvania P5-A locomotives saved 32,000 lb. per locomotive. A similar application could be made on locomotive *B* and would more than meet the requirement of 8,750 lb. remaining.

Space Saving of Small Engines

Another productive source for weight saving could be realized by arranging the Diesel engines and generators to take advantage of the reduced engine space requirements of small-bore engines. If full advantage could be taken of this space saving, the engine compartment could be made one half the length needed for the large engine installation. This might easily result in savings of an additional 100,000 to 125,000 lb. not included in the original comparison. The improvement in performance resulting from such a saving should be an incentive for a careful analysis and vigorous attempt to accomplish this result. It is obvious that weight saving by complete elimination of material not only does not add to the cost of any product but actually reduces it. Engineering along these lines pays large premiums and can make the final economic picture so attractive that new applications are justified and replacement of existing equipment may be desirable.

Conclusions

1—Weight saving in the locomotive improves all of its operating characteristics except the advantage of high tractive force at starting and for speeds up to about 20 m.p.h.

2—The greatest single weight saving can be made in the engine and can be accomplished by reduction in bore, increased rating and by the use of light materials of construction.

3—The use of small bore engines and suitable arrangement of these engines can reduce the length of the locomotive and result in additional weight reduction.

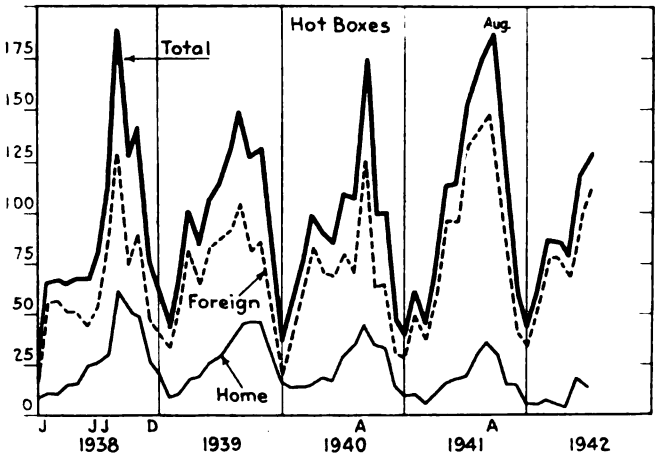
No analysis has been made of the possibilities of saving weight in the electrical equipment, air brake equipment, trucks and axles, and the locomotive frame. Unquestionably, the use of aluminum alloys as well as other material developments and design improvements would produce weight saving in these parts. The road locomotive of the future can best serve its destiny by being designed to use all of the available weight and space saving methods that can be conceived. If it results in such light weight that starting tractive force is insufficient for satisfactory train performance, ballast at a few dollars a ton will always be available.

Some Notes on Hot Boxes*

By C. B. Smith†

WASTE grabs are the primary causes of hot boxes. They are responsible for from 50 to 95 per cent of all hot boxes, increasing from 1938 to date. Sixty per cent of these occur within 50 miles of the starting point.

Waste grabs result from a disturbance of the journal packing causing it to roll up under the edge of the bearing and to work under the bearing when it is jumped off the journal by a severe shock to the car. Shock speeds upward from five miles an hour at impact will begin to move the packing. In the winter, low temperatures will cause packing particles to adhere to the rising side of the journal before the journals have warmed up, lodging



The heavy black line shows total hot boxes, the lighter line those on home-owned cars, and the broken line those on cars of foreign ownership—Boston & Maine

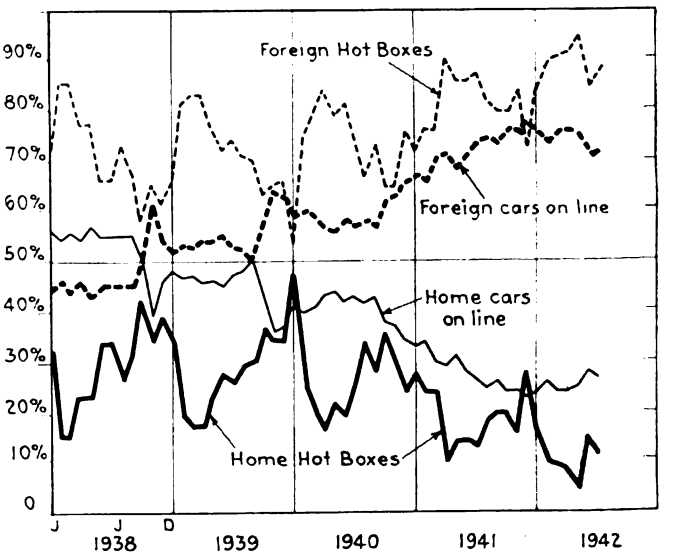
them at the edge of the bearing where they can work under it at the first shock.

The major problem to be solved in preventing waste grabs is to keep the packing from rolling up under the edge of the bearing on the rising side of the journal. Devices to accomplish this have been tried on some roads but none seem to have progressed to adoption on a large scale. One railroad system has developed such a device with which it is having encouraging success. Two pieces of wood, 1 in. shorter than the journal, ⅝ in. to ½ in. thick and 1¾ in. to 2 in. wide, are placed front and back of the journal on top of the waste packing. These pieces are connected to each other at their outer ends by a strip of steel baling tape which, when bent into position in the front of the box, holds the wooden strips and prevents the packing from rising.

Early trials with these wooden strips were not satisfactory because the pieces were nearly the length of the box and rode past the axle collar. What happened to these strips was a most convincing proof of what transpires within a box when heavy brake applications or severe end shocks occur. The axle collar jammed against the wooden strips, first denting them and finally breaking some of them, causing splinters which later worked up under the brass to drop on the packing. Some splinters were found embedded in the linings of the bearings. The present shorter pieces of wood do not come in contact with the axle collar. The device seems worthy of trial on other roads.

Study Performance

It is believed that more study could profitably be given to journal-box performances by a tabulation of failures and a graphic chart display of conditions and events from month to month. The changes and trends over long periods are very impressive and should stimulate closer attention to efforts to reduce the number of hot boxes. Such records, gathered from forms filled out by inspectors, should show the following data: number of hot boxes; freight car miles per month; mileage divided between home and foreign cars and private line cars; gross ton miles, cars on line, both home and foreign; causes of heating; percentage due to waste grabs; accumulated time of train delays and miles per hot box. Other important data to be tabulated would be: dates; car numbers and initials; train number or symbol; delay, if any; date and place of last jacking and repacking; elapsed time since repacking; whether car was serviced



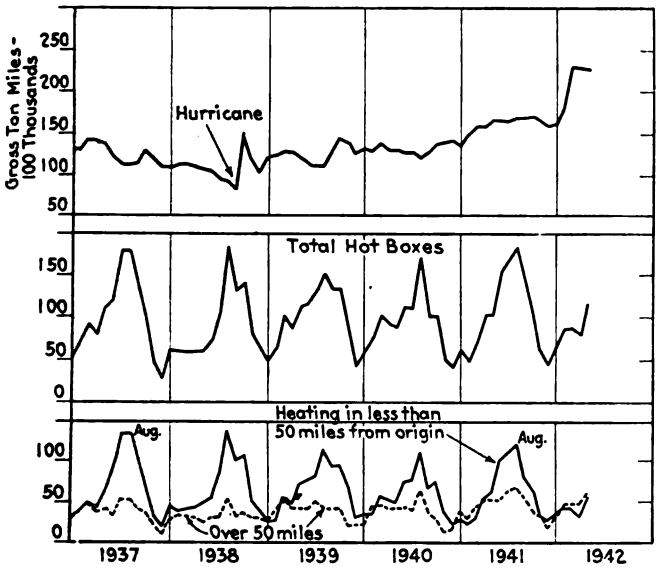
The proportion of hot boxes on home and foreign equipment is compared in this chart with the proportion of home and foreign cars on line—Boston & Maine

or not prior to train departure; starting point of car; whether car was loaded or not; distance from starting point where heating occurred; where car was set out of train; condition of bearing, packing and oil content, and any other relative data or remarks.

It has been the custom for several years on the railroad with which the author is associated to keep a monthly record of hot box analyses. These records have been charted, some of them over a period of eleven years. Similar charts prepared on other roads show that there are trends, common to all, year by year. The most im-

* Abstract of a paper delivered before the New England Railroad Club at Boston on December 8, 1942.

† Engineer of tests, Boston & Maine.



Top: Gross ton-miles—Center: Total hot boxes—Bottom: Solid line shows hot boxes occurring within fifty miles of starting point, broken line those which occurred beyond fifty miles from the starting point—Boston & Maine

pressive feature of the charts is the high peak of summertime hot boxes and the falling off from this peak toward the end of the year.

In the coldest winter weather it is customary to give attention to the starting of trains by providing men and facilities for applying a squirt of warm oil to the rising side of journals as the trains start. This assures lubrication until running temperatures develop sufficiently to supply oil for the bearing. No similar attention has been devoted generally to lower the tendency to develop hot boxes in the hot, dry summer months.

Summer Conditions the Worst

The reasons for expecting an increase in the number of hot boxes in the summer has been indicated by laboratory tests. High atmospheric temperatures narrow the range of interior journal box temperature due to the condition of the packing and oil. The dry condition of packings, as found after protracted hot spells, especially in mid-western districts, has caused excessive heating in large numbers of cars moving in trains coming from farther west.

In 1941 efforts were made successfully to reduce such heatings by applying a gill or so of water to the journal boxes. Applied on the falling side of the journal this water soaked into the packing and restored the mosture content. This procedure was used again in the summer of 1942. The plan worked until the application of water got beyond control. The use of too much water led to discouraging the practice. Restoration of moisture in packing is legitimate and reduces running temperatures. Excess applications are unfortunate. Further efforts with better controls and the education of all concerned may yet lead to the wider use of this method of handling the summer problem. Beginning with the early summer season, limited quantities of water may be applied with the oil in reclamation plants to raise the one per cent moisture of renovated packing to a known desirable amount without the danger of harmful effects in service.

The lesser number of hot boxes occurring in the winter months is probably due, in part at least, to the congealed condition of the packing before it has been warmed by friction. It is prevented from rolling up in the box so readily and, also, cars roll more slowly when humped or switched which lowers the effect of impact shocks.

Whose Responsibility?

Many conditions, either singly or in combination, can cause hot boxes in interchange freight cars. The responsibilities for them do not rest entirely upon any one railroad handling cars made up from a great variety of roads through joint interchange yards and road terminals.

It is common knowledge, confirmed by records, that the performance of journal boxes runs about the same, and has done so, year after year. No coordinated effort has been made to see what can be done specifically to reduce heating conditions all over the country. The roads have been left to solve their problems individually. This hardly seems consistent with procedures that have developed couplers, draft gears, springs, truck side frames, bolsters, etc., and officially established them by mandatory instructions.

This lack of action cannot be because hot boxes are trivial events in car operation. Little is known as to the cost of hot boxes, taking into account all of the expenses involved, some of which are difficult to evaluate. Opinions range from the hundreds of thousands into the millions of dollars annually. One figure, based on expenses observed over a period of months, indicated $40 as an approximate cost per box. Fifty hours a month in train delays were shown in the same study, and the total annual estimate of cost on this road was $20,000.

It would seem that the whole subject is worthy of the combined and coordinated study by all railroads acting under the authority and direction of the Association of American Railroads.

Free Height and Spring Cushioning Capacity

By C. J. Holland*

A spring is a yielding member that is installed between the running gear and the body of a vehicle, because experience has demonstrated that a cushioning member is absolutely necessary to minimize the shocks due to unevenness in the roadway.

As the speed of the vehicle increases, the shock intensity increases; and therefore, greater shock-absorbing capacity should also be had. However, in the case of railroad freight cars, which carry loads from the empty car to the fully loaded car, the ideal spring condition cannot be provided, because what is ideal for the fully loaded car is altogether too stiff for the empty car. What we can do is to be sure the spring shock capacity is sufficient for the fully loaded car and yet as soft as possible for the empty car.

It is obvious that bolster spring groups are now taking extra punishment because of the heavier loads cars are carrying, the higher speeds at which they move, and also because it is impossible to keep all tracks up to normal standards, due to the increased movement over the rails and to restrictions in the supply of replacement rails and accessories. Under these conditions, the harmonic action of bolster spring groups is accentuated and bouncing often builds up and accumulates until it gets above the capacity of new spring groups.

There is no A. A. R. rule with regard to removing springs, but it is obvious that broken springs should be replaced. It is also obvious that if there are evidences of springs being driven solid, the reasons therefor should

* President, C. J. Holland Company, Chicago.

be investigated. The reason might be: (1) overloading, (2) permanent set in some of the springs, (3) lack of snubber, or shock capacity in the group.

The high-speed operation of tank cars has focussed attention upon the necessity of maintaining higher cushioning and shock capacity in their spring groups, with the result that the A. A. R. and the American Petroleum Institute agreed that snubber springs are needed in tank-car spring groups, and have issued instructions to apply snubber springs to all tank cars.

The inspector will naturally mark for replacement any springs that are broken. However, springs which have taken a permanent set are not so easy to discover. The diagram, illustrated, indicates how important it is to replace such springs. It visualizes the loss in capacity in springs which have taken different degrees of permanent set: the A. A. R. specifications for a new spring call for a normal free height of 8¼ in. In this condition the new spring has $1\frac{11}{16}$ in. of deflection or compression.

Under an empty car, the 8¼-in. springs are supposed to take a deflection of about ¼ in., which means that the distance between the top and bottom plate should be about 8 in., at which point the remaining deflection or compression would be $1\frac{7}{16}$ in. So if any of the springs in a group have taken sufficient permanent set to decrease cushioning capacity unduly, this fact can be discovered by measuring the distance between the top and bottom spring plates.

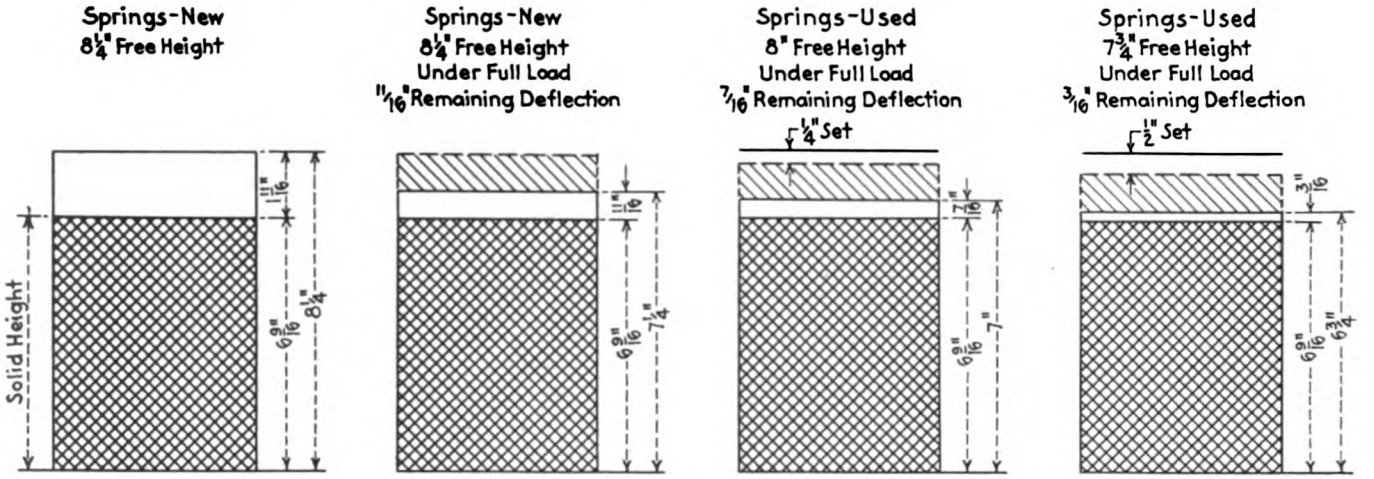
If the distance between the spring plate under the empty car is less than 8 in., one or more springs have probably taken a permanent set.

If the car is loaded to capacity, the distance between the spring plates of the nest should be 7¼ in., at which point the remaining deflection or compression is only $1\frac{1}{16}$ in. If this distance measures only 6¾ in., there is only $\frac{3}{16}$ deflection or compression remaining—and the condition approximates no springs at all.

The moral is plain. A limit in the permanent set of spring groups should be established beyond which point the springs should be taken out, and those having a permanent set should be replaced. This does not mean that all such springs must be scrapped; many of them can be reconditioned by the spring manufacturers, thus conserving materials and preventing waste.

Where one or more springs in a group have taken a permanent set, the remaining springs are carrying more than a normal load, and then all springs are likely to be driven solid frequently under capacity loads; thus imposing excessive stresses and shocks on truck frames, bearings, journals, etc., and also hastening the time when all springs must be replaced.

This indicates the necessity, importance, and economy of requiring inspection to locate shortened springs and to remove them promptly. If this is done, an important saving in delays to shipments and in bolster spring costs can be made and the safety of operation can be improved.



Effect of reduced free height on cushioning capacity of spring group

If the free height of the A. A. R. 1915 truck spring is reduced from 8¼ in. to 8 in., then under a fully loaded car (1-in. static deflection) the reserve travel left in the springs to take care of shocks is reduced by the same amount, from 11/16 in. to 7/16 in. Springs that are less than 8 in. in free height should be removed and reconditioned, if the bar diameter is not less than 1⅛ in. and has not been excessively punished by going solid. If the free height of the above spring group is reduced to 7¾ in., then under full load, the reserve travel is reduced from 11/16 in. to 3/16 in., and in this case, for all practical purposes, they are no longer springs; they are solid blocks.

* * *



The original is 14 in. by 18 in. The colors are blue, red and black

CMP and the Railroads*

By Brig.-Gen. C. D. Young†

Transportation inadequately protected by lack of representation and by weaknesses of blanket priorities system—High hopes expressed for effectiveness of CMP with ODT a claimant agency

A REVIEW of the conditions necessitating a radical change in the War Production Board in order to make a proper distribution of the scarce critical materials I believe can be made from my own personal association with the subject. I was called to Washington by Director Eastman of the Office of Defense Transportation the day before Christmas of 1941 to assume the duties of Director of Materials and Equipment and to assist in the organization of that office. It is one thing to be a part of and grow up with an organization such as a railroad; it is quite another thing to find oneself a part of an organization that does not exist and to perform duties in intimate relations with other government agencies with which he has no acquaintance and in which there is an expanding and changing personnel. Superimposed on this organization problem is the vagueness of the character of the problem. The conception of this problem had been a matter of study for more than a year under the able leadership of Ralph Budd.

Owing to the ever-increasing burdens in the broad problem of coordination and obtaining maximum utilization of domestic transportation, the organization of necessity rapidly expanded and, today, a little over one year later, the headquarters and field organization of the Office of Defense Transportation has expanded into a substantial personnel. The great majority are located in the field and are essential in order that directives may be issued and information needed be furnished with expedition and the public be properly advised without the necessity of travel to Washington.

Early Relations of ODT with WPB

At the time of the organization of ODT the present War Production Board had been reorganized out of OPM and Donald M. Nelson assumed chairmanship of the board. There was a tentative railway program for the maintenance and equipment requirements for the first quarter of 1942 which had been developed by the Civilian Supply Division of OPM in consultation with Mr. Budd's organization. Our office was charged with preparing, by the middle of February, an integrated program for all forms of domestic transportation. This was to include the requirements for all agencies of transportation; namely, the railroads; the motor truck and bus vehicles of the highways; the metropolitan area transit operations; pipe lines; the waterways of the Great Lakes, inland, coastal and intercoastal, and warehousing as it affected transportation.

With the assistance of the operators of the various forms of transportation, together with the industries supplying them with material and equipment, this program was presented and was the basis for future consideration by WPB for the 1942 requirements. The stated needs were greater than WPB felt could be allotted to domestic transportation and reductions were made in the estimates and a curtailed program granted for the full year. However, the priority system under which material was obtained was faulty to the extent that there was no assurance of a completion of the program on the schedule authorized.

Late in February I was transferred from the Office of Defense Transportation to the General Staff of the War Department, and in March, at the time of the formation of the Services of Supply, I was made Director of Procurement and Distribution for the War Department, in which office I was responsible for the purchasing, production and distribution to storage depots of all the services of the Army, such as Quartermaster Corps, Ordnance Department, Chemical Warfare Service, Signal Corps, and Medical Corps.

In this position it became increasingly evident to me that to maintain a uniform flow of materials for proper manufacturing and maintenance under the priority system, with the limited quantities of material available, some new plan of distribution to all claimants would have to be evolved. My assignment in the War Department brought me into close association with the Army and Navy Munitions Board. This Board similarly recognized the desirability of a more suitable plan of material control and as early as May, 1942, studies were initiated to improve the distribution of critical materials to the various claimants. The PRP plan came into being and this afforded some relief but it did not meet the basic problem of equitable distribution in accordance with the needs of various agencies of government and the civilian requirements, and in November Chairman Nelson inaugurated, to become effective in 1943, the Controlled Materials Plan.

Early WPB Plan Inadequate Protection for Transportation

Having left the Army to return to a new assignment with the Office of Defense Transportation as assistant director in July, it became evident to me that domestic transportation could not be fully protected under the system then in effect of having representation in WPB of the transportation equipment and material needed. In December, other government agencis having arrived at the same conclusion, a modification was made in the original plan of controlled materials by introducing, in addition to the original claimant agencies, those of transportation, petroleum, defense housing, Office of Rubber Director, Food Administrator, and Facilities Bureau of WPB.

These claimants now represented on the Requirements Committee of WPB have relieved the civilian supply of the duty of claimancy for them and by so doing present

* Abstract of a paper on ODT as a Claimant Agency in the WPB's Controlled Materials Plan presented at the meeting of the Railway Club of Pittsburgh held at Pittsburgh, Pa., on January 28.

† General Young is deputy director, ODT.

their claims directly to Vice-Chairman Eberstadt of WPB.

It is my considered judgment that the Controlled Materials Plan is fundamentally sound and as the plan becomes operative the allocation of critical materials will be expanded beyond that of steel, copper and aluminum, and the division between the Class A and Class B products will be simplified. The undertaking is so gigantic during the transitional stage from priority to allotment that the change will have to be by steps based on experience as the Controlled Materials Plan becomes effective.

Procedure Under CMP

Under the new plan the ODT, as a claimant agency, receives a determination from the Requirements Committee of a program, which program is offered in units and then resolved into material both for maintenance and equipment. In the presentation of the program it is necessary to convince the Requirements Committee of the needs as stated in the program offered. As a result of the conviction of the Requirements Committee of the efficiency of the use of the available facilities, the Requirements Committee made their determination as to the program for the first six months for freight cars and for the first six and eight months of 1943 for locomotives. Further supporting evidence has recently been presented to the Requirements Committee as it approaches a determination of the locomotives for the full year, final determination not having yet been concluded. However, under the CMP it is expected there will be an allotment in the second quarter steel production for a portion of, and perhaps all, of the last half of the year's equipment program.

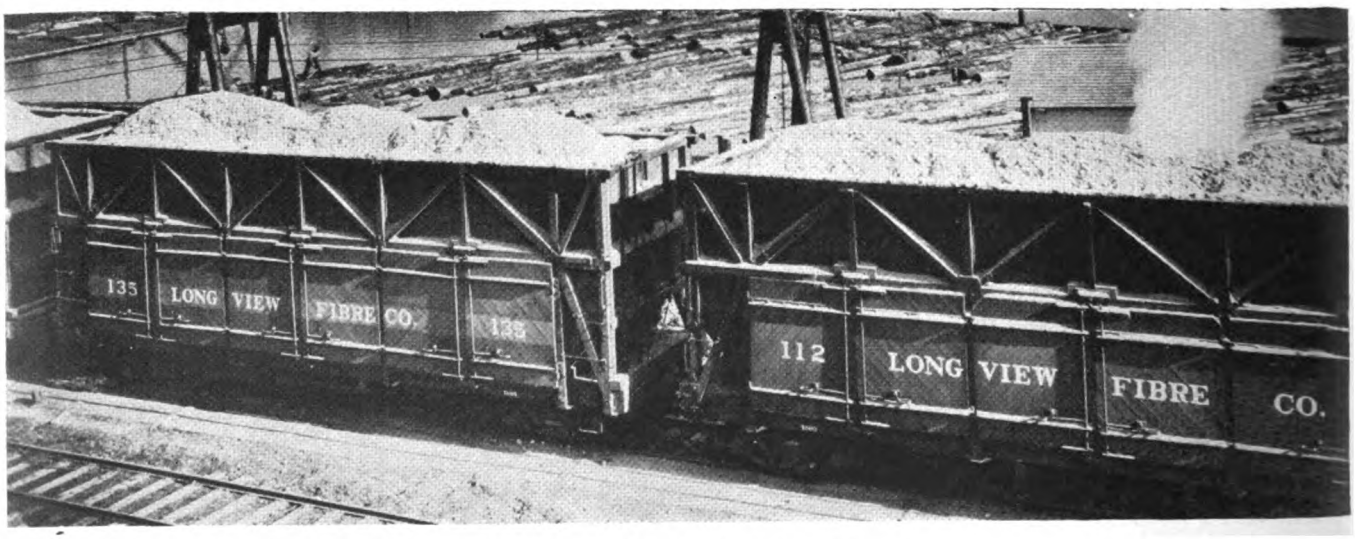
The full determination of the quantities of rail for 1943 has not yet been concluded, but it is evident from the needs of the other claimants that 1943 will not see any more generous treatment than that which was accorded in 1942. In the face of this level of new rail for replacement the carriers have been required, and willingly have given, almost all of the fit rail for purposes of plant expansions and for other purposes to the government in order that the government might obtain the maximum utilization of the rail available and to provide the carriers with the new and heavier sections of rail, retiring to other government activities the fit rail suitable for the large government needs.

I am quoting from a published article by George M. Cornell, deputy director, Transportation Equipment Division, War Production Board, for by so quoting I can give you the development of the CMP as related to the requirements and production of fabricated parts. He says: "The problem of balancing supply and demand for fabricated parts, however, will require the development of some new technique. To date, supplies of fabricated parts for railroad maintenance and repair have been purchased under the provision of blanket priority ratings set up under General Priorities Order P-88 with some slight assistance on bottleneck items by means of Form PD-1A and PD-351. The only restriction on purchase has been the general limitation provision of the order regarding excess inventories. No information is at hand as to the distribution of these requirements of fabricated parts among various categories of products other than the very general classifications of Form PD-352 and these classifications include not only fabricated parts but raw materials as well. On the supply side of the picture the information available, in so far as WPB reports are concerned, is contained in the files of the PD-25A reports for railway supply manufacturers. Railway supply requirements, however, are so varied that compilation of data solely from the supply angle presents insurmountable details."

I have high hopes for the Controlled Materials Plan; it is being splendidly administered and with the cooperation of the railroads I predict that the uncertainties of the past, as regards the amount of material available to you for maintenance and new equipment will, when public announcement is made, be replaced by assurance of a supply in the future.

The Material and Equipment Requirements Division of ODT is available at all times for service to the procurement officers of the railroads for whatever information and assistance they desire. We invite their questions, comments and criticisms and request that they be placed in writing so that they may be given immediate and serious consideration without the danger of the misunderstanding which does occur from oral statements.

* * *



Pressure-treated lumber increases car life

Before construction with pressure-treated lumber, these cars, used in hauling wet wood chips to the pulp mill of the Longview Fibre Company at Longview, Wash., had a maximum service life of only four or five years—This was caused by rapid decay of untreated lumber at joints and around the floor—Spontaneous heat generated in the wet load further accelerated the activity of the decay fungi—With the use of treated lining and framing material in reconstruction, this company has more than doubled the life of its chip cars—The two above are part of a fleet of 48 operated at Longview and built with Wolmanized Douglas fir.

EDITORIALS

You Tell Us!

We must utilize every possible manpower-hour and day in the mechanical departments of our railroads. Men will remain away from work for one reason or other. Even in normal times these absences upset work schedules and operations, but today, with the shortage of skilled help and when the railroads are stressed to the very limit to keep the boys at the front supplied and at the same time to meet our civilian needs, the loss of even one manpower-day at a critical point may have serious results—let alone the loss of many manpower-days at many places. *How can we reduce absenteeism to a very minimum? What practical suggestions have you to offer?* Drop a letter to the Editor and let's see what our roundtable will develop; your letter must be in our New York office not later than March 16 for use in our April issue.

Hot Box Elimination

Elsewhere in this issue appears an abstract of a paper presented before the New England Railroad Club by C. B. Smith, engineer of tests, Boston & Maine. Over a period of many years Mr. Smith has been a close student of the hot-box problem. Approximately six years ago he addressed the same organization on this subject and in the present paper has brought the record up-to-date. Most significant is the indication which he gave that the over-all picture had not improved appreciably in that period.

Mr. Smith acknowledged that there had been various methods pursued by individual roads, by the A.A.R. and by specialty manufacturers to improve performance but indicated his belief that the subject was not one which could be adequately covered or efficiently dealt with in any but a completely coordinated manner. He suggested what appears to be the best plan of action. Attack the problem as a common one; deal with it in the same manner as couplers, draft gears, springs, side frames, bolsters, etc., have been dealt with in the past. Only by so doing can adequate performance records be assembled and from them determinations made of what is necessary to overcome a major and expensive problem on every railroad. While the frequency of hot boxes per journal mile is very low it is probable that it can be still further reduced by careful and coordinated study and effort.

In the meantime, only one other thing can be done, each railroad must endeavor to improve its present performance. A further suggestion would be that it attempt to make known as widely as possible any methods which contribute to better performance.

More Intensive Use of Locomotives

The particular conditions essential to maximum locomotive utilization have been widely studied and publicized, but it is difficult to give too much consideration to this important subject. In discussing it at a recent meeting of the Western Railway Club in Chicago, the point was made that improvement in the metallurgy of firebox steel, boiler tubes, etc., have made possible greatly increased miles between general repairs or heavy boiler work, thus making locomotives available for road service a higher percentage of the time. In this connection, the need for a higher quality of workmanship in boiler construction and maintenance is apparent in order to overcome certain difficulties now being experienced with boiler shell and seam cracks which are apparently not chargeable to defective material.

Improvements in the technique of boiler-water treatment are also credited with contributing to successful

long locomotive runs and extending the period between washouts, also reducing the development of scale and pitting on flues and firebox sheets with attendant substantial reduction in out-of-service time of locomotives for boiler work. There is still apparently a difference of opinion regarding the advantages and disadvantages of applying copper ferrules between flues and flue sheets, nevertheless most railroads have developed a technique which practically eliminates leaking flues, a former prolific source of trouble, expense and delay in connection with the operation of locomotives.

Discussion at the meeting referred to emphasized again how much can be accomplished in the way of quicker servicing of locomotives at intermediate terminals, primarily by the relocation of coal and water stations. It was stated that on the main line of the Chicago, Burlington & Quincy between Chicago and Denver, for example, the installation of modern coal shed, water crane, and cinder-handling facilities at strategic points permits locomotives to be coaled, given a full tank of water, fire cleaned and ashpan cleaned in from four to six minutes, where this servicing attention formally required 15 to 20 minutes. A modern heavy 4-6-4-type locomotive consumes approximately 137,000 gals. of water and 85 tons of coal on the round trip between Chicago and Denver, and the problem of supplying this large amount of fuel and water is a very real one. The intensity of locomotive use on this particular railroad is indicated by the fact that with a total performance of approximately 3,000,000 locomotive-miles a month, almost 23 per cent of this mileage is made by a fleet of modern steam locomotives which are only 7 per cent of the steam locomotives owned.

The Manpower Problem

Industry and transportation in this country are being seriously handicapped by the shortage of manpower. The problem in the coming months will not become any easier with the demands that are being made for men by the armed services, and the fact that the farmers must be supplied with labor during the growing and harvesting seasons if we are to be assured an adequate supply of foodstuffs. A man-hour saved by doing the job in a better way is worth just as much, or more, than if it is necessary to secure that additional man-hour by adding to the working force.

There are many ways in which manpower can be conserved and used to better advantage. We have referred elsewhere to the problem of absenteeism. It is significant, also, that the railroads, as well as industry, are giving more and more attention to the training and improvement of supervision, in order that through better administration and direction the available manpower may be used to the best possible advantage. Statistics are not available, but a considerable percentage of the executives and supervisors are today taking advantage of various types of training courses, in order to improve their leadership ability; in other words, they are trying to find how to get a better job done, with the expenditure of the same or fewer man-hours.

The Erie Railroad, as an example, has adapted a method devised by the Training Within Industry Division of the War Manpower Commission, for training its officers and supervisors in better methods of teaching the employees under their jurisdiction as to the most effective way in which to carry out their duties. From last accounts there were at least 2,000 supervisors taking this instruction on that railroad. On the New York Central about 3,000 supervisors are enrolled in somewhat similar courses. The supervisors and employees of that system are also taking advantage of courses sponsored by State Departments of Vocational Training and other foremanship training courses promoted locally. Many of its employees are enrolled in special college courses sponsored by the United States Office of Education.

These are only two of a number of roads whose supervisors and employees are striving earnestly to take advantage of study and discussion courses, to help them to make the best use of the available manpower.

Insuring Power Supply

Electric power travels over wires from the generator to the point where it is used. Somewhere along the way there are almost always transformers. Being static devices, transformers receive little attention. Actually they do not need much, but they should receive some, since the many thousands which the railroads have in service represent a large investment in strategic materials, notably copper, steel, insulation and oil, and they are essential for continuous power supply.

Observation of a few simple rules will practically eliminate the possibility of a transformer failure. The first rule is to read carefully and follow the instructions accompanying the equipment, before installing it. Periodic tests during operation should include checking the oil level, and noting the difference between the temperature of the air and that of the transformer. Too high a temperature usually means overload. Overheating may also be caused by sludge in the cooling coils of water-cooled transformers. This may be removed by filling them with equal parts of hydrochloric acid and water for an hour, after which they are thoroughly flushed. Oil sludge on core or cooling coils may also be a reason for excessive temperature. If the air temperature is above 104 deg. F., the transformer should not be required to carry full rated load.

In time it is almost certain that moisture will get into transformer oil. Every six months to a year, a sample of the oil should be given a dielectric test. For railroads not equipped to do this, the manufacturers maintain a service at a nominal cost. If the test indicates moisture in the oil, it can be filtered at a manu-

facturer's local service shop. Moisture in the coils may be removed by heating with low-voltage current or by blowing hot dry air through the transformer after the oil is removed or by drying the core in an oven. Spare transformers require maintenance just the same as transformers in operation.

There is nothing in these suggestions that is not in the possession of any railroad, but in strenuous times like these it is easy to overlook what someone has called "tremendous trifles."

War Materials From Railway Shops

Since transportation is such a fundamental factor in the manufacture and delivery of all materials to the fighting front, railroads are making a great contribution to the war effort in carrying on their ordinary operations of periodic servicing, maintenance and repairing of both cars and locomotives. In all probability, a general survey would show that railroads are also manufacturing and turning out at local repair shops a far greater tonnage of war materials such as gun mounts, tank parts, etc., than is commonly appreciated. It is obvious, therefore, that maximum railway shop production is more essential now than ever before and amply justifies reviewing present machine equipment, shop operating methods and personnel organization with a view to discovering weak points and making the changes required to give increased output.

In this connection, it is interesting to note that a progressive manufacturer of commercial forgings recently installed a number of drop hammers ranging from 6,000 to 20,000 lb. capacity, together with dual furnace equipment for each hammer, and trimming and straightening presses for the manufacture of accurate drop-forged machine parts. He provided mechanical handling equipment for the movement of raw materials, finished parts and scrap, the latter, which includes flashing, butt ends, etc., being loaded directly into railway cars for daily return to the steel mills. Straight line production methods are used for progressing both raw materials and finished parts through the plant and by the broader use of labor-serving equipment, the production of the plant has been increased about four times while man-power requirements have been increased only two and one-half times.

A special feature of the new plant equipment is the provision for all heating and heat-treating operations to be under complete laboratory control with chemical and metallurgical determinations and also photo-micrograph studies of test bars to give immediate information regarding all phases of the manufacturing process. Particular attention may also be directed to the new types of inspection equipment which were installed for making surface determinations, including a new luminous Magnaflux test department.

The question may well be raised, Why are railway men interested in a high-production plant such as that mentioned, where only a relatively few different kinds of parts are manufactured in great quantities? The answer is that forward-looking ideas incorporated in these plants may sometimes be adapted, to some degree at least, in railway shop operations and moreover almost any large railway shop does a certain amount of manufacturing work in which a sizable volume of locomotive or car parts has to be produced. When, in addition to this work, railroad shops are required to turn out certain war materials in greater or less quantities, it is obvious that railway shop managements and supervisors are failing in duty to their country, their railroads and themselves unless they become thoroughly familiar with the full possibilities of modern shop production methods and apply these methods insofar as practicable to the work in their respective shops.

New Books

ENGINEERING MECHANICS. *Published by Longmans, Green and Co., Inc., 55 Fifth avenue, New York. 252 pages, illustrated, 5½ in. by 8¼ in.; cloth bound. Price, $4.50.*

This is a compact book of eleven chapters, British in origin. The treatment is both mathematical and graphic. The first four chapters deal with velocity and acceleration; the fourth is devoted wholly to acceleration diagrams. One chapter is devoted to force, torque, work and energy, and another to simple harmonic motion. Between these is one dealing with dimensions and dynamical similarity, in which is developed the principles of dynamical similarity and the application of this useful tool to problems of the determination of indices in formulae. The remaining four chapters are on analysis of cams; Motion of Rigid Bodies in Two Dimensions; Vibrations, and Deflections of Beams. Throughout the book the principles are illustrated by practical examples, to which the answers are given at the end of the book.

LET'S WRITE GOOD LETTERS. *By Sherman Perry. Published by the American Rolling Mill Co., Middletown, Ohio. 176 pages, 8¾ in. by 5⅜ in. Bound in Cloth. Price, $1.00.*

This short text book on business letter writing, like its successor, "Making Letters Talk Business," first published in 1924, is a practical guide to the principles of composition and mechanics of writing. The first part of the book suggests, and illustrates with good and bad examples, ways to make the content of business letters clear and effective, yet concise and tactful. Separate short sections deal with words, phrases, sentences, paragraphs, and organization of thought. Nearly half the book is devoted to practical rules and useful suggestions for the secretary and typist, including a concise summary of good business usage and a review of "essential English." Following this is a chapter on "Essentials of Report Writing," a subject important to anyone whose activities include correspondence.

THE READER'S PAGE

Brake Shafts Cannot be Welded

To the Editor:

We note on page 40 of the January, 1943, issue of the *Railway Mechanical Engineer,* an article in relation to building up worn brake shafts by welding. We realize the savings that could be accomplished by employing this operation, but if you will refer to the A.A.R. Code of Rules governing the interchange of traffic, effective January 1, 1943, rule 23, you will note that the welding of brake shafts is not permissible and the item in question is not further qualified that building up worn surfaces is permissible and which specific qualification would be necessary to permit the building up of worn surfaces on brake shafts.

A. R. Green,
Supervisor car maintenance,
New York, Ontario & Western,
Middletown, N. Y.

[The statement in this letter is entirely correct. Not only do the A.A.R. rules prohibit this practice but the regulations of the I.C.C. governing safety appliances state specifically that brake shafts shall be 1¼ in. in diameter without weld.—Editor.]

Conflicting Views About a Boiler Patch

To the Editor:

I note with interest the boiler patch as described on pages 385 and 386 in the September, 1942, issue of the *Railway Mechanical Engineer.*

An examination of this patch reveals that the efficiency in the outer row of rivets at the 4-in. pitch is:

$$\frac{4 - 1\frac{1}{32}}{4} = 74.2 \text{ per cent}$$

The factor of safety, according to the formula:

$$\frac{TS \times t \times E}{r \times P} = 3.19$$

where TS = minimum tensile strength = 55,000 lb. per sq. in.
t = shell thickness = ¾ in.
E = efficiency = 74.2 per cent
r = radius of boiler = 42⅝ in.
P = steam pressure = 225 lb.

If the efficiency is considered from this viewpoint, then the patch should have two additional end rivets as shown in the drawing. The efficiency then becomes:

$$\frac{4 - 1\frac{1}{32} \times .75 \times 55{,}000 + 1\frac{1}{32}^2 \times .7854 \times 44{,}000}{4 \times .75 \times 55{,}000} = 96.4$$

The corresponding factor of safety is:

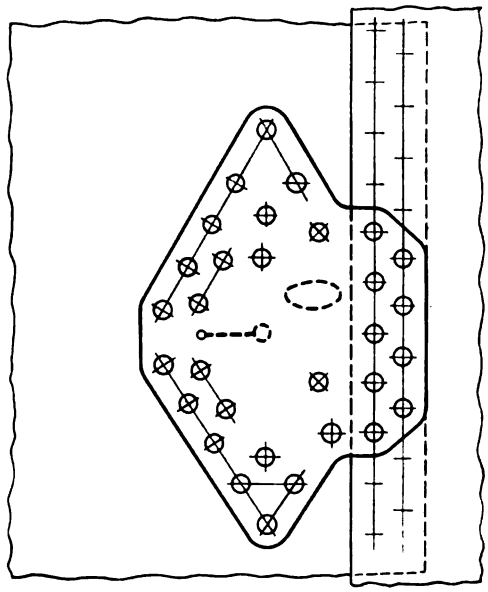
$$\frac{55{,}000 \times .75 \times .964}{42.625 \times 225} = 4.14$$

E. L. Vohl,
Special engineer,
Gulf, Mobile and Ohio,
Jackson, Tenn.

[This letter was forwarded to L. R. Haase, master mechanic, Baltimore & Ohio Terminal, Chicago, who had contributed the original paper. His reply follows.—Editor.]

To the Editor:

I do not agree with Mr. Vohl's method of figuring the efficiency of this boiler patch due to the fact only two 1 1/32 in. holes are drilled along a horizontal line and in



Are additional rivets shown in this sketch necessary?

this particular case it is unnecessary to figure the efficiency at this point and not necessary to have an additional rivet at each end of the patch as shown on your sketch.

It has always been considered good boiler practice that you could drill a maximum of three holes in a row before considering the efficiency. For instance, boiler braces for either front or back flue sheets or the throat sheet have three holes drilled in the shell in a horizontal plane and we do not consider this efficiency.

Of course, if a series of holes are drilled in a horizontal line in the shell of a boiler it would tend to weaken the plate and, in turn, would decrease the efficiency of the shell to such an extent that it would be less than the longitudinal seam, in which case, the lower efficiency would be used.

L. R. Haase,
Master mechanic,
Baltimore & Ohio,
Chicago Terminal, Chicago.

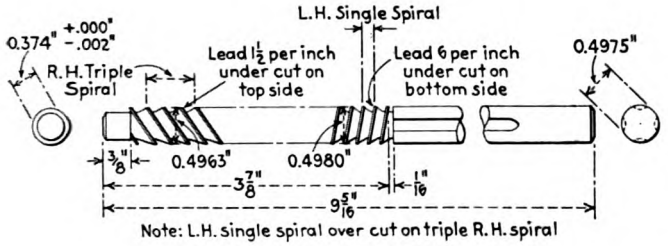
IN THE BACK SHOP AND ENGINEHOUSE

Spiral Reamer To Straighten Holes

Straight holes in which the axis is not permitted to be bowed more than 0.0001 in. in 4 in. can be obtained with a fast spiral reamer developed by Howard Fancher, a methods man at General Electric's Schenectady Works.

The reamer enlarges the hole approximately 0.002 in. It is especially useful in producing straight holes through which rows of cross holes have been drilled.

The tool can be made easily, its cutting edges hold up well, and sharpening is not difficult. The left-hand



Spiraled diamond-cut reamer

spiral flutes are shaped like a buttress thread. One-, two-, and three-flute reamers have been used.

The lands are interrupted by a right-hand triple-spiral flute with 1½ threads per in. The lands are not relieved and it has been found that up to 0.012 in. width of land is permissible.

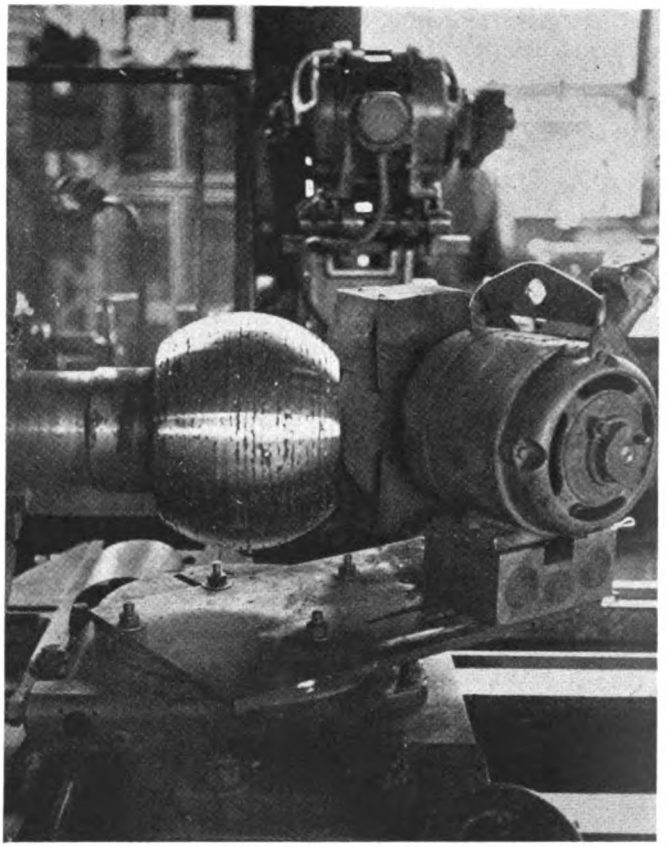
The radial face of the left-hand spiral flutes is toward the starting end of the reamer. This space is ground with a 5-deg. positive rake. Only ¼ in. of length of the reamer is straight and to the required size. The next 2-in. portion is tapered 0.0017 in. smaller toward the starting end. The next ¾-in. portion is tapered 0.0003 in. smaller to the starting end of the reamer.

Both the straight and the tapered portions of the reamer are cylindrically ground. The fluted shank, which acts as a back pilot or guide, is cylindrically ground 0.0005 in. smaller than the finish diameter of the reamer teeth. The flutes in the shank facilitate the flow of cutting oil to the reamer.

For a reamer in the neighborhood of ½ in. in diameter, a left-hand thread of six threads per inch, and a triple right-hand thread of 1½ threads per in. have been found satisfactory.

Grinding Spherical Surfaces

After rebuilding flexible radius-bar balls with a hard-facing welding rod the Southern Pacific, at its El Paso shops, grinds the surfaces to proper size in a jig which consists of a circular milling attachment bolted to a plate which is fastened to a lathe cross-slide and which has a plate bolted on top of the milling attachment. A



Jig for grinding spherical surfaces

portable motor-driven grinder is mounted on this top plate. The circular feed of the grinding wheel is obtained by gearing the circular milling attachment to the gear on the lathe cross-feed screw.

How to Increase the Life of Worn-Out Tools

*By J. S. Gillespie**

When your high-speed steel cutters are "worn out," don't scrap them. They are still good—on the same job—usually for several times the original life of the tool.

The simple way to reclaim these tools is to braze tips of Carboloy to the cutting surface of the tool, letting the tip project slightly beyond the edge of the tool and then grinding the tool to size. When the tools wear undersize—they will probably take a lot longer to do this than did the original tools—they can be brought back to size by moving the tips out slightly. To do this, heat the tips until the braze is loosened and then move them out enough for regrinding.

This procedure of tipping high speed-steel tools may

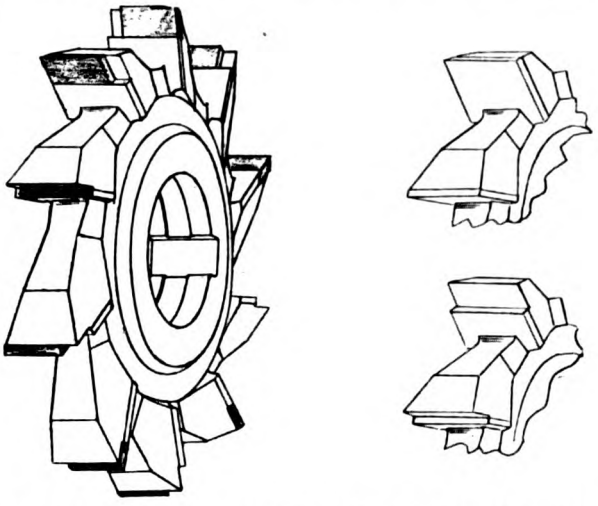
* Engineer, Carboloy Co., Inc., Detroit, Mich.

be followed, as a matter of fact, not only for the purpose of reclaiming such tools when they are worn out but actually before the tools are completely undersize. Even new tools in stock may be tipped when it is desirable to convert operations immediately to carbides for increased production.

The process has the advantage of greater tool economy. It usually costs less to tip a tool with carbide than to buy a new steel tool and the tipped tool lasts longer. Furthermore, the practice conserves strategic tungsten, since an ounce of tungsten in a carbide tip will do the work in many cases of several pounds of tungsten in other forms of cutting tools.

Grinding the High-Speed Steel Tool

The actual procedure in reclaiming a multiple-point tool is first to grind back the faces to which the tips are



This sketch suggests how worn-out cutting tools may be reclaimed by the use of small carbide tips

to be brazed. The depth to which these faces are to be ground depends on the thickness of the tip to be used. During brazing, the tips should be placed so that they line up.

It is not necessary to grind a recess for the tip. The latter may be brazed to a flat surface, since tool loads are rarely so great as to demand a support around the tip.

The prime difference between tipping an ordinary steel shank and a high-speed steel shank with carbide is that greater care has to be taken to prevent oxidization. When you heat high-speed steel, there is a tendency for the chrome contained in the steel to be driven out.

If the chrome is allowed to oxidize, it forms a coating to which it is difficult to make a braze adhere, since standard brazing compounds will not wet chrome oxide properly.

To overcome this is not difficult, however. The main things to observe are that the shank shall be heated quickly and no more than necessary, and that plenty of flux be used to keep the chrome from oxidizing. It also helps to move the tip with a rod if possible when the shank is heated to help wet the steel surface with the Easy-Flo No. 3.

Brazing

When the tip is brazed to the shank, it is allowed to stick out slightly over the edge of the steel. After all the tips are brazed in place, the complete tool is then re-ground to the proper diameter, etc.

When the tool wears down in service, to bring it back to size it is necessary merely to apply heat to the tool, loosening the braze, move the tips out slightly, and allow the braze to set again. The tool is now re-ground to proper size. This procedure can usually be repeated several times during the life of the average tip, and tips can be replaced with new tips when necessary. In this way the original life of the tool is multiplied many times.

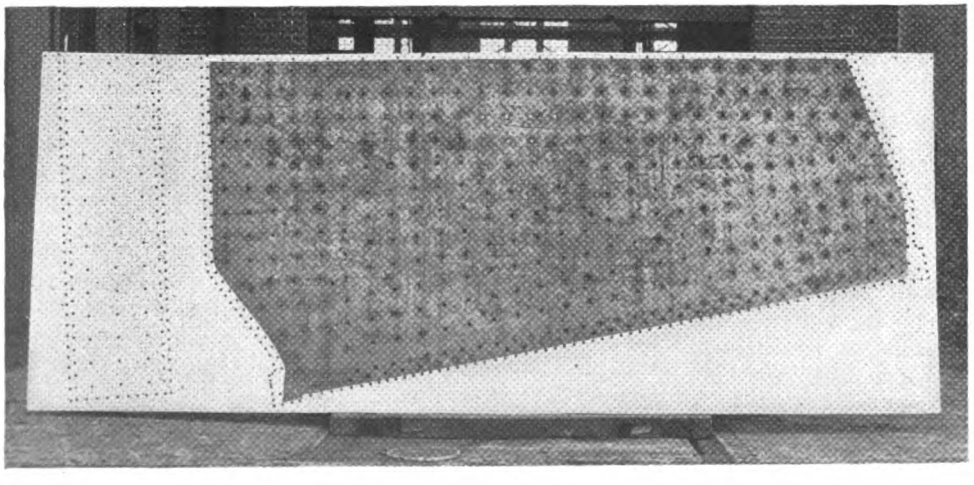
While the preferable method of brazing tips to steel shanks is to heat the shank rather than the tip, it is necessary sometimes to heat through the tip to keep previously-brazed closely-adjacent tips from coming loose. When this is done, care should be taken to heat the entire tips evenly to prevent cracking due to uneven expansion of the carbide.

With short tips a conventional braze is entirely satisfactory. Where tips are relatively long, however, it is usually better to employ a sandwich braze in which a sheet of constantan is placed between layers of Easy-Flo No. 3. This helps relieve brazing strains due to possible uneven cooling and the difference in expansion and contraction between steel and tungsten carbide.

In heating either through the shank or the tip it is desirable to use a torch small enough to concentrate the heat where needed and large enough to provide effective heating of the entire areas desired. The tip, Easy-Flo No. 3, and flux should be in place before the heating is begun, to avoid oxidizing.

This tipping procedure is being currently followed for such wide ranges of tool classifications as conventional milling cutters, reamers, counterbores, side mills, core drill, spot facers, fly cutters, end mills, etc.

* * *



Type of template used in laying out half side sheets for locomotive boilers at the Louisville & Nashville shops, South Louisville, Ky.

Flues Without Copper Ferrules*

Part I

By S. Christopherson†

A study of methods and results of setting tubes directly against steel sheets

Too often flue-shop machinery is obsolete or inadequate and poorly arranged. Up-to-date flue-shop equipment is economical and can be purchased and installed at a moderate cost and, in a short time, it will repay the expenditure.

Service life of flues and tubes depends largely on the use of modern equipment, cleanliness of preparation, proper welding machines for safe-ending and good practice in application. The correct procedures require proper inspection of flues and tubes, flue and tube holes, a periodical check for contour and size on all tools used, and the proper handling of these tools in the working of the flues and tubes. Then the job will be done right with a minimum of time and labor involved.

The service life of flues and tubes applied without using copper ferrules has proved to be as satisfactory as in applications made with the ferrules. There may be a little more care needed in fitting flues or tubes into holes by having the right swaging done so as not to thin out the material.

Proper Practices in Use of Flue or Tube Tools

Experience on several locomotives of the 2-10-2 and 4-8-4 types, carrying boiler pressures from 200 lb. up to 265 lb., over a period of several years indicate that copper ferrules can be eliminated. There have been some cases when trouble started within 20,000 miles, but in the check-up it was found that the trouble was caused by a poor job done by the use of improper tools. We have also had the same trouble with locomotives having copper ferrules. In our estimation, one is as good as the other provided a good job is done.

With the following procedure, we feel that a good job can be done without copper ferrules. All flues and tubes removed from boilers should have the ragged ends cut off and cleaned before the tubes are safe-ended. After cleaning, whatever method is used, flues or tubes which are found to be light in weight, pitted or worn to one-third of the original thickness and weight should be scraped. This practice saves good material and eliminates failures on the road by weeding out the poor flues or tubes.

Safe-Ending Flues and Tubes

Two- and 2¼-in. flues should not, under ordinary conditions, contain more than three welds. For the duration, four welds are recommended on flues in good condition. Three and one-half and 5½-in. tubes should not, ordinarily, have more than two welds. For the duration, three are recommended. For the duration, it is recommended that, when an entire end is needed to bring flues or tubes back to required boiler length, an old flue or tube not over 72 in. in length be used as a safe-end, provided the old flue or tube is in good condition, and a new 6-in. flue or tube be added as the second weld for the firebox end.

Tools for Working Flues and Tubes Without Copper Ferrules

The straight gauging prosser, shown in Fig. 2, is used on 2-in., 2¼-in. flues and 3½-in. tubes for setting and

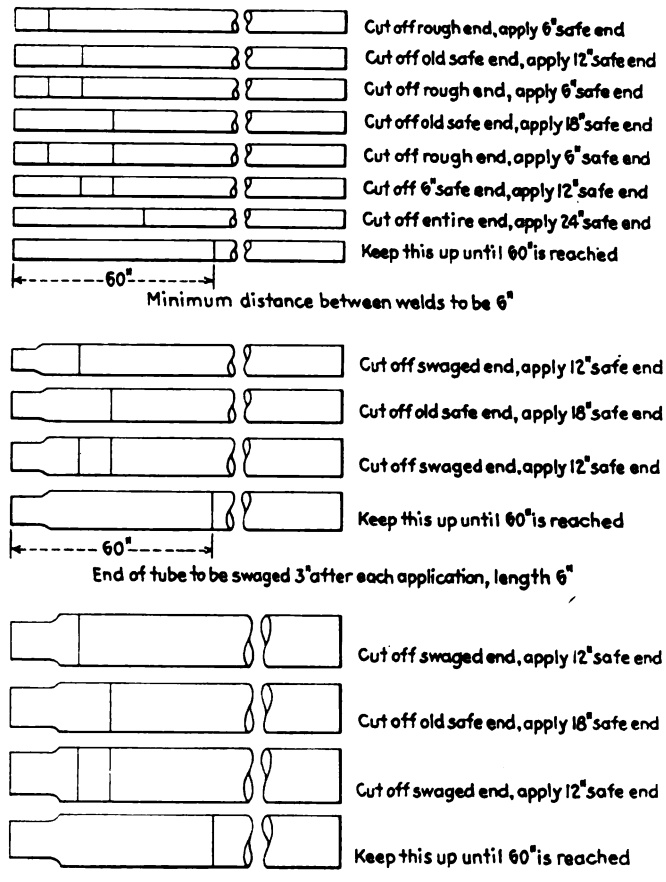


Fig. 1—Safe-ending practice—Above: 2-in. and 2½-in. tubes—Center: 3½-in. tubes—Below: 5½-in. tubes

tightening. All tools should be of the railroad's adopted standard.

A flaring roller expander should be used at all points where new flues or tubes are applied, as it will save the

* Abstract of a paper submitted as part of the report of Committee on Topic No. 2 on the application and maintenance of boiler flues for the 1942 year book of the Master Boiler Makers Association.

† Mr. Christopherson, who was vice-chairman of the Committee on Topic No. 2, is supervisor boiler inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.

operation of belling over. This tool is shown in Fig. 3. The Form B modified prosser, used on 2-in. and 2¼-in. flues and 3½-in. and 5½-in. tubes after the flaring roller has been used, is shown in Fig. 4. The Form C prosser,

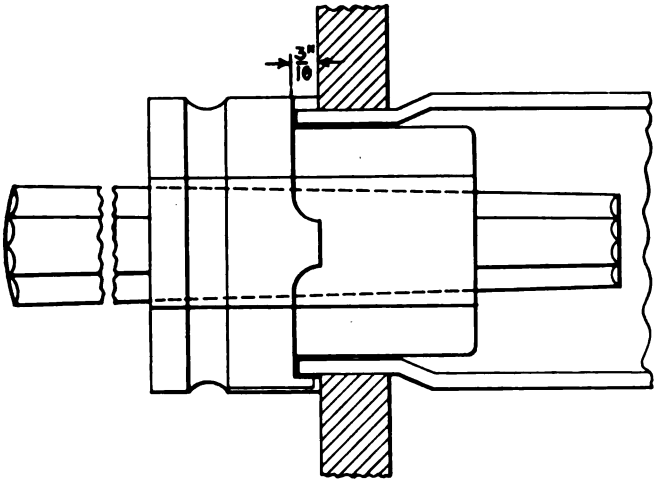


Fig. 2—Form F straight-gauge prosser

Fig. 5, is used on hot work for 2-in., 2¼-in. and 3½-in. sizes when they are leaking slightly.

In the application of flues and tubes, no oil should be used on the tools as it may get under the bead and make it impossible to obtain a good welding job. Use a good cutting compound instead.

Have the firebox end of the flue cleaned, place the flue in the hole, using Form F tool, fitting it neatly and

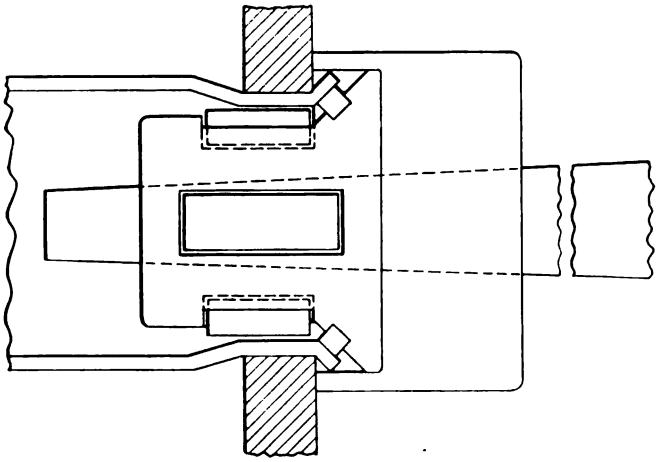


Fig. 3—A flaring type roller expander

setting it at the same time. The flue should not project through the back flue sheet more than 3/16 in. Set 5½-in. tubes with a ball pein hammer. Tubes should not project through the back flue sheet more than ¼ in.

Two-in. and 2¼-in. flues and 3½-in. and 5½-in. tubes should be tightened and flared in the back flue sheets with a roller expander having flaring rolls. Use these rollers just enough so that the flue will bell over the beading.

Two-in., 2¼-in. and 3½-in. sizes should be expanded by the use of a Form B modified sectional expander. Drive the expander pin, with pneumatic hammer, until it is fairly solid. Draw out the pin and give the expander a turn equal to a one-half section. Drive the pin a third time. This should give the full set of the expander. After expanding, examine all flues carefully. Those which have split in the recess formed by the expander or have a crack from the end of the flue into the sheet should be removed before the beading operation.

The firebox end of the 5½-in. tubes should be expanded by the use of Form B modified sectional expander. Using a No. 6 pneumatic hammer, drive the expander pin until it is fairly solid. Draw out the pin and give the expander a turn equal to one half a section. Drive the pin the second time. Withdraw the pin and turn the expander equal to one quarter of a section. Drive the pin a third time. This should give the full set of the expander.

The firebox end of all flues and tubes should be beaded. This should be done with the railroad's standard beading tool, using a short-stroke pneumatic hammer. Care should be taken to see that nothing enters between

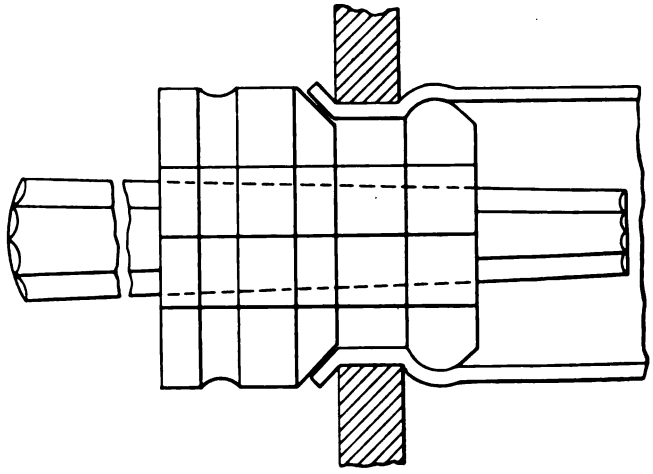


Fig. 4—Form B prosser

the bead and the flue sheet. The center line of the beading tool should always be inside the line of the flue or tube. Remove any burrs that may have formed with a small chisel and hand hammer. No beading tool should be used which does not conform to the railroad's standard.

On new sheets holes for 2-in. and 2¼-in. flues should be the same diameter as the swaged flue and no copper

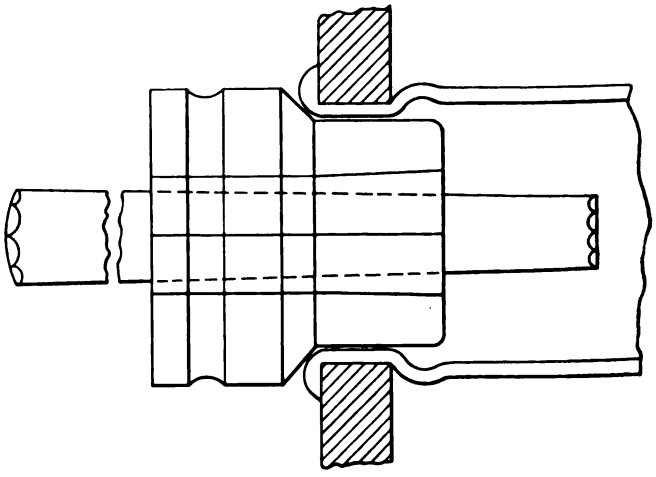


Fig. 5—Form C hot-work prosser

ferrules should be used. The flues should be swaged to 1⅞ in. and 2⅛ in., respectively.

On new sheets, the holes for superheater flues should be of the same diameter as the swaged tube. No copper ferrules should be used. The 3½-in. flues for Type E superheaters should be swaged to 3 in. The 5½-in. flues of Type A superheaters should be swaged to 4½ in.

(To be concluded in the April issue.)

With the Car Foremen and Inspectors

Rules for Cleaning and Patching Tank Car Tanks

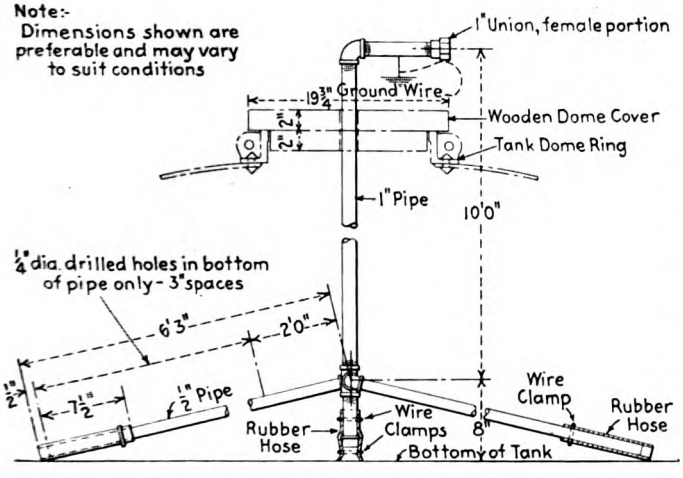
An A. A. R. Mechanical division circular, No. DV-1040, issued under date of December 15, 1942, states that in view of the present emergency situation with respect to transportation of petroleum and its products to the eastern seaboard and other critical areas and the shortage of critical materials such as plate steel, it is necessary, in order to keep the maximum number of tank cars in this service, to make repairs, wherever possible, by the application of riveted patches to riveted tanks where plates are cracked or ruptured. The following note has, therefore, been adopted to follow Interpretation No. 1 to interchange Rule 16:

"Note.—For the period of the emergency and until further advised, the requirements of Rule 16 with respect to patching of riveted tanks of tank cars are waived and will be governed by instructions for riveting patches on riveted tanks of tank cars issued in Circular DV-1040, dated December 15, 1942."

The circular includes the following instructions for the safe preparation and patching of riveted tanks of tank cars used for the shipment of petroleum products and other inflammable liquids during the emergency, these instructions having been approved by the Committee on Tank Cars and the General Committee of the Mechanical division for the benefit of railroads who have not had previous experience in repairs of tank cars.

Preparing Tank Car Tanks for Repairs

Empty tanks of cars previously used for the transportation of inflammable petroleum products such as crude

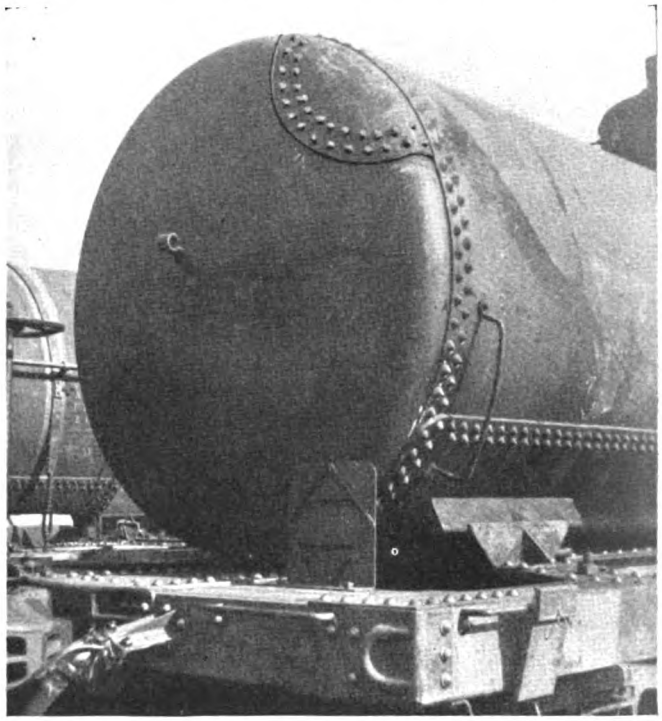


Approved equipment for steaming out tank car tanks as suggested by A.A.R. Mechanical Division

oil, gasoline, kerosene, fuel oil, etc., or other inflammable liquids such as alcohol, etc., contain inflammable vapors mixed with air, forming highly explosive mixtures. No employee shall be permitted to enter any car tank previously used to transport inflammable liquids until after it has been prepared as outlined below.

The tank must be steamed with live steam for at least three hours and until warm to the touch and then flash tested to determine if it is gas free and safe for workmen to enter.

To prevent explosions, all forges and other open fires must be kept at least two car lengths away from the tank



Double-riveted patch applied to double-riveted tank head of an A.R.A. Class III car

being steamed. Steaming must be performed outside of shop buildings. Employees must not smoke in or around tank cars being cleaned.

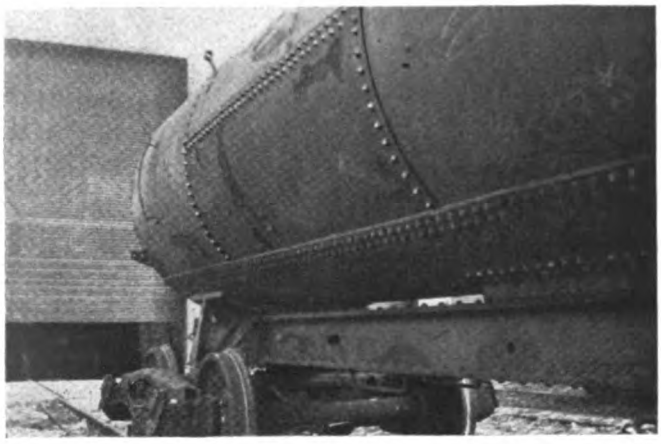
The steaming operation must be performed with the utmost care and in an economical manner. Steam should enter the tank by means of a non-sparking metal pipe, or pipe properly protected against sparking, inserted into the tank through the dome. Connection between the yard steam line and the pipe passing through the dome must be by means of a steam hose at least one inch in diameter. The steam hose must be equipped with non-sparking metal couplings.

To dissipate static, one end of a ground wire must be securely fastened to the pipe passing through the dome and the other end secured to the track rail by means of a suitable clamp to prevent its displacement. The yard steam supply line must also be thoroughly grounded. Each steam hose coupling must be joined to the coupling at the other end of the same section of hose by two wires

of suitable length for static control, as shown in one of the drawings.

The bottom outlet cap must be removed during the steaming operation and the internal outlet valve must be fully opened to allow condensation to escape. The dome opening must be closed with either a wooden cover, or heavy canvas to avoid waste of steam.

After the tank has been thoroughly steamed, preparatory to entering, it must be "flash-tested" for oil fumes by lowering a ball of burning waste into the interior by



Patch applied to the shell sheet of an A.R.A. Class III tank with single-riveted girth seams

means of the apparatus shown in the other drawing. Inserted through the dome, and lowered until it strikes the bottom of the tank, the container of burning waste is raised a few inches and allowed to remain at least a minute to prove the absences of oil fumes which would make it unsafe for a man to enter. If the waste is not burning when withdrawn, it must be relighted and re-inserted. After completion of the flash test, the burning waste is extinguished. Only a small supply of waste soaked with kerosene is kept available for flash-testing purposes.

After the tank has been satisfactorily "flash tested," and has cooled sufficiently to allow workmen to enter, it shall then be inspected. If found to have an accumulation of scale, sludge, etc., these should be removed using only non-sparking tools, or flushed out using water hose having non-sparking nozzle and couplings. If scale and sludge cannot be flushed out, it must be kept wet while being removed. Employees removing sludge and scale must wear rubber footwear while performing this work. After scale and sludge are removed, the tank shall be given an additional steaming of from one to three hours, depending upon the quantities of these items removed, to make it gas free. The tank shall then again be satisfactorily "flash tested" before employees are permitted to re-enter for any necessary repairs.

Should it be necessary to again enter the tank on the following day, the dome opening and outlet valve must be left fully open over night in order to properly vent the tank. Before any employees are permitted to re-enter the tank, it shall again be "flash tested."

Riveting Patches on Tank Car Tanks

All patches must be open hearth boiler plate steel of a quality complying with A. A. R. specification M-115. All rivets must comply with A. A. R. specification M-110 for boiler rivet steel and boiler rivets.

Patch thickness must not be less nor $\frac{1}{16}$ in. greater than the thickness of the original sheet. (a) All patches must be applied externally. The cracked or damaged area to be patched, including a section extending 2 in. beyond the defective area, shall be removed. The opening so made, whether removed by chipping or burning, must have rounded corners and the edges must be carefully chipped to provide the proper calking edge. (b) When repairing sheets with cracks only it will be permissible in lieu of the above to apply a "blind patch" in the following manner: It will not be necessary to cut out the cracked section, but a hole, of a diameter equal to the thickness of the sheet being repaired, must be drilled at each end of the crack. After being prepared as outlined, the crack must be covered with a patch, either inside or outside, meeting all requirements outlined in these instructions except for calking of the defective sheet against the patch.

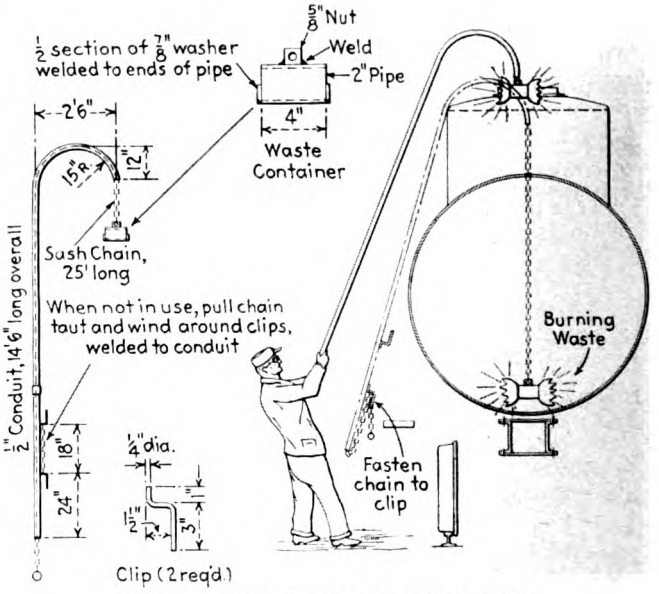
All riveting, beveling and calking must comply with A. A. R. Specifications for Tank Cars. All patch seams and rivets shall be calked inside and out. Tanks must be tested in accordance with A. A. R. Specifications for Tank Cars.

Patches applied to the shells of A. R. A. Class III, I. C. C. Class 103, A. R. A. Class IV, and I. C. C. Class 104 tanks shall be double riveted except for the plates used to close openings for handling heater coil pipes through tank heads. Patches applied to the dome head seam shall be riveted in accordance with the original construction.

Patches applied to A. R. A. Class II tanks with single or double riveted tank head seams and double riveted bottom sheet seams shall be double riveted except at single-riveted seams. Plates closing openings used for handling heater coils through tank heads shall be single riveted.

Patches applied to the shell or bottom sheets shall be rectangular. Longitudinal patch seams shall be parallel and girth patch seams perpendicular to the original longitudinal tank seams.

When the portion to be cut out extends to, or is within 10 in. of outside calking edge of the seams, the cut out



Safety apparatus for testing tank-car tanks

shall be extended to the outside calking edge, with corners properly scarfed before application of the patch.

Patches applied to the bottom sheet under slabbing or anchor shall extend beyond the slabbing or anchor a sufficient distance so that rivets will be outside the contact areas.

Machine for Forming And Rolling Brake-Shoe Keys

The brake-shoe key rolling and forming machine illustrated is used at the Atchison, Topeka & Santa Fe shops, Topeka, Kans. The machine, slightly over 11 ft. long, sets on and is bolted and clamped to a steel slab platform, supported by stands which were made from scrap main rods.

The hydraulic valve control gives a maximum pressure of 1,400 lb. per sq. in. in a 6-in. inside diameter cylinder *C* which is 61½ in. long. To the free end of the piston rod is connected the guide *G* and roller box *B*, the latter housing a series of four rollers in both top and bottom halves. The rollers are machined with disc flanges at each end, which limit the width of the keys. The dimensions of the rollers increase in size progressively from the front roller to the back one, in order to give the required taper to the keys. The lower half of the roller box works along a grooved bed, which is a heavy slab superimposed upon the platform.

A stationary guide or former *F* is keyed to the butt-block *M* at the end of the machine. A tapered tongue runs the length of this guide on both top and bottom surfaces. Dies for forming the proper radius after the two keys are rolled, tapered and cut are placed under the front end of the cylinder at *D*. They are kept open by the two coil springs which are attached at each end of the male die, and placed at each side of bed. This die is actuated when the piston is drawn backward in the cylinder.

In the rolling operation, the roller box *B* is drawn back beyond the end of the taper-tongue former *F*, and a piece of heated steel, long enough to make two keys, is centered over the end of the former. Application of pressure in the hydraulic cylinder moves roller box *B* to the right, bending the stock around the former and rolling out the stock along the taper tongue forming two keys, one on the top and one on the bottom of the former *F*. When the end of the stroke is reached, a cutting die, keyed into the guide head *G*, cuts the stock, thus making two keys in a single operation.

This machine has a production capacity of 1,000 brake-shoe keys per eight hours.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

153—*Q.—What takes place at the quick-service valve during the HSC brake application?* A.—At the quick-service valve (Fig. 18) air from the straight air pipe builds up through passage *4* and chamber *C* under the diaphragm *22*. At approximately five pounds this pressure overcomes spring *29* and deflects the diaphragm *22*, moving follower *23* and its guide. Spring *28* is compressed and seats cut-off valve *27*, closing the connection between passage *3* and the exhaust, *Ex*. If local brake fluctuation should reduce the brake pipe pressure in chamber *A*, and cause the piston and slide valve to move to application position, a reduction in brake pipe pressure will be prevented by the closed cut-off valve *27*.

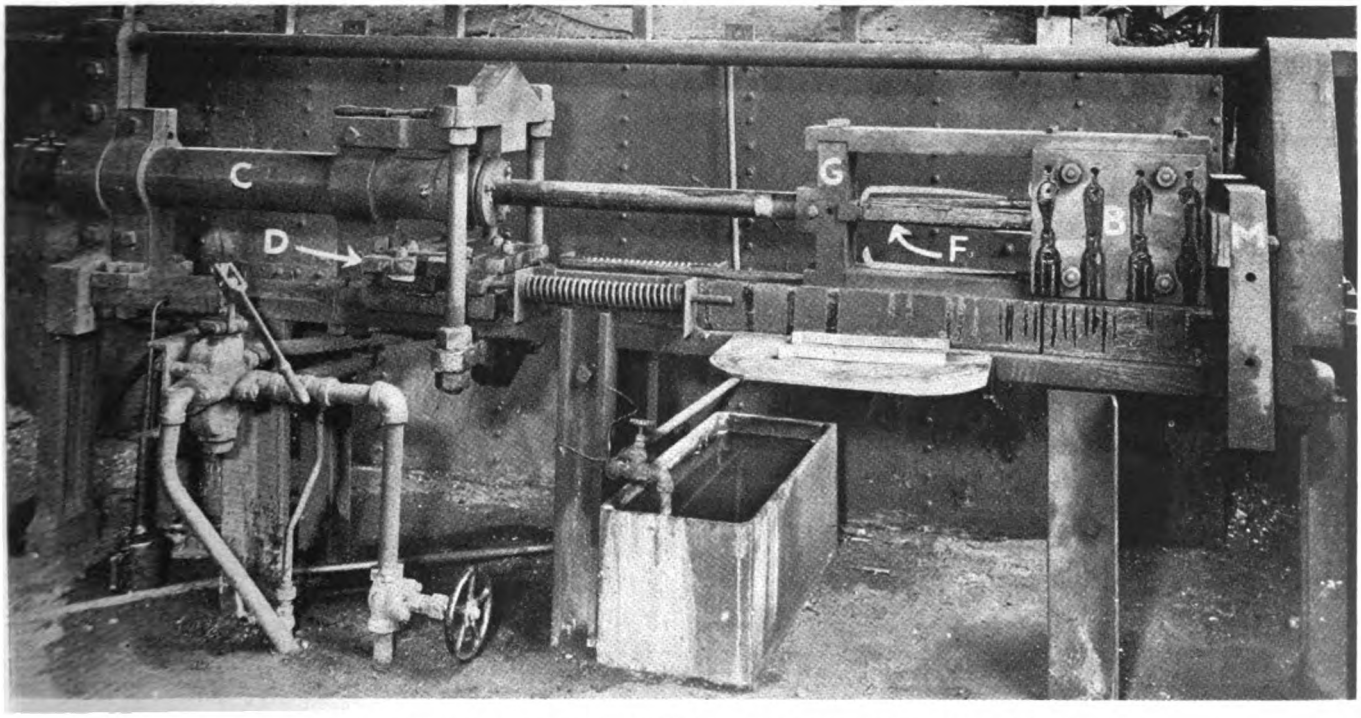
154—*Q.—How is the braking force reduced following an HSC brake application?* A.—By moving the locomotive brake valve handle toward release position.

155—*Q.—Does this fully release the brake?* A.—No. The release is accomplished by placing the handle in release position.

156—*Q.—How does the 21-B magnet valve function at this time?* A.—The release magnet valve *62* on the 21-B magnet valve is unseated at this time.

157—*Q.—How is the unseating of the release magnet valve accomplished?* A.—The master controller on the locomotive de-energizes the release wire and, therefore, the release magnet of the 21-B magnet valve. Spring *35* then unseats the release magnet valve.

158.—*Q.—What occurs at the opening of this valve?*



Brake-shoe key-forming machine which forms 1,000 keys a day at the Topeka shops of the Santa Fe

A.—The exhaust is opened so that the pressure from passage *4a,* the straight air pipe, and diaphragm chambers of the FS-1864 relay valve is reduced the same amount that the control pipe pressure is reduced on the locomotive.

159—*Q.—Explain the operation of the FS-1864 relay valve and the consequent release of brake cylinder pressure.* A.—A corresponding reduction is made in the diaphragm chambers *A, K, N* or *P,* whichever is in control. As the pressure is reduced in passages *16, 16a* and the check valve chamber, the greater pressure in the controlling diaphragm chamber *K, N* or *P,* lifts check valve *51, 51a* or *51b* and reduces into passage *16.* Also the *K-3* switch closes and disconnects the battery supply when pressure in No. 16 line is reduced to about 5 lb. As the pressure is removed from the left side of the main diaphragm *38* the higher brake cylinder pressure in chamber *F* of the relay portion and spring *42* return piston *36,* and its lever *43.* With pressure removed from exhaust valve *23* and its piston *25,* brake cylinder pressure opens them and flows to the atmosphere. After the pressure is reduced below the inshot spring valve, spring *88* returns the inshot piston *84* and diaphragm *85* and opens supply valve *92.*

160—*Q.—Is a graduated release possible?* A.—Yes. In making a graduated release the relay portions will lap and retain the brake cylinder pressure in accordance with the lapping action of the master controller as controlled by the locomotive brake valve so that the brake cylinder pressure can be released in small increments to produce a smooth stop.

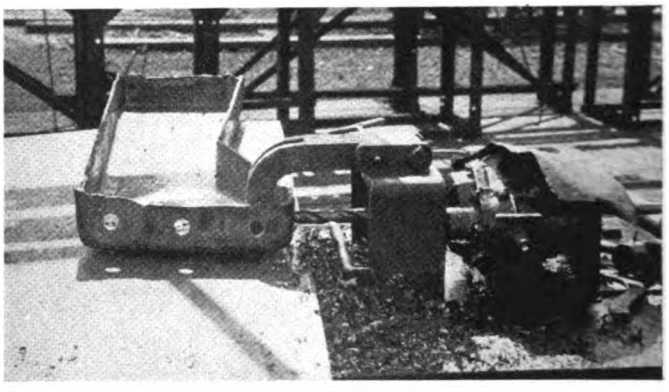
161—*Q.—How is the reduction transmitted when an emergency rate of reduction occurs, due to the movement of the brake valve handle to emergency positions?* A.—The reduction is transmitted serially from car to car.

162—*Q.—Describe the effects of this reduction.* A.—At the D-22-BR control valve (Fig. 17), the emergency rate of brake pipe reduction reduces the pressure in chamber *B,* on the face of the emergency piston. Quick action chamber pressure on the opposite face of the piston cannot reduce through the vent port *t* in emergency graduating valve *30* and port *y* in the slide valve to atmosphere at the same rate, therefore, sufficient differential is built up across the emergency piston to compress spring *49* and allow the graduating valve *30* to move far enough on the slide valve to open port *t1* in the slide valve which registers with port *t2* in the seat, allowing quick-action chamber air to flow to the face of vent valve piston *42.* The resulting movement of this piston unseats the vent valve *40,* opening a large and direct passage from brake pipe passage *1b* to atmosphere. The rapid venting of brake pipe air causes an emergency reduction rate of brake pipe pressure to pass serially and rapidly through the train, due to the same operation of connected valves, and insures the prompt movement of the valves on other cars to emergency position. The rapid reduction of brake pipe pressure causes the emergency piston and slide valve to move to the extreme right position which carries slide valve port *t1* out of register with seat port *t2,* but port *t2* is now uncovered by the tail port *t3* in the slide valve so that quick action chamber pressure remains connected to the vent valve piston. The emergency slide valve now connects the spring side of the high-pressure valve *44* to the exhaust port *Ex.,* through passage *h1* and cavity *h2* in the slide valve *29.* This vents air pressure from the spring side of the high-pressure valve, and emergency reservoir air in passage *2,* acting on the outer area of the face, unseats this valve, permitting emergency reservoir air to flow through passages *3h, 3c* and *3* to the displacement reservoir, the rate of flow being controlled by choke *21* in passage *3h.* Meanwhile, the emergency rate of reduction in brake pipe pressure has caused the service piston and slide valve to move to the extreme left where the graduating valve uncovers the service port *f,* through which auxiliary reservoir pressure flows into passage *3b* and to the displacement reservoir passage *3,* combining with the flow from the emergency reservoir. The pressure in the emergency and auxiliary reservoir, therefore, quickly equalize through passage *3* into the displacement reservoir, developing a higher pressure than obtained from electro-pneumatic or automatic pneumatic service brake application. In an electro-pneumatic emergency application from the brake valve, after the maximum brake application of 75 lb. has developed electrically, the higher combined pressures move the check valve *228* to its opposite seat, connecting the emergency, auxiliary and displacement reservoir pressure to passages *16a* and *16,* thence to the FS-1864 relay valve which operates to produce maximum brake cylinder pressure subject to speed governor regulation as described for service braking.

163—*Q.—Will an emergency brake pipe reduction from a conductor's valve or a broken brake pipe develop maximum brake cylinder pressure in the same manner?* A.—Yes, except that the electro-pneumatic brake application will not precede it. The maximum pressure is the same, however, under all emergency application.

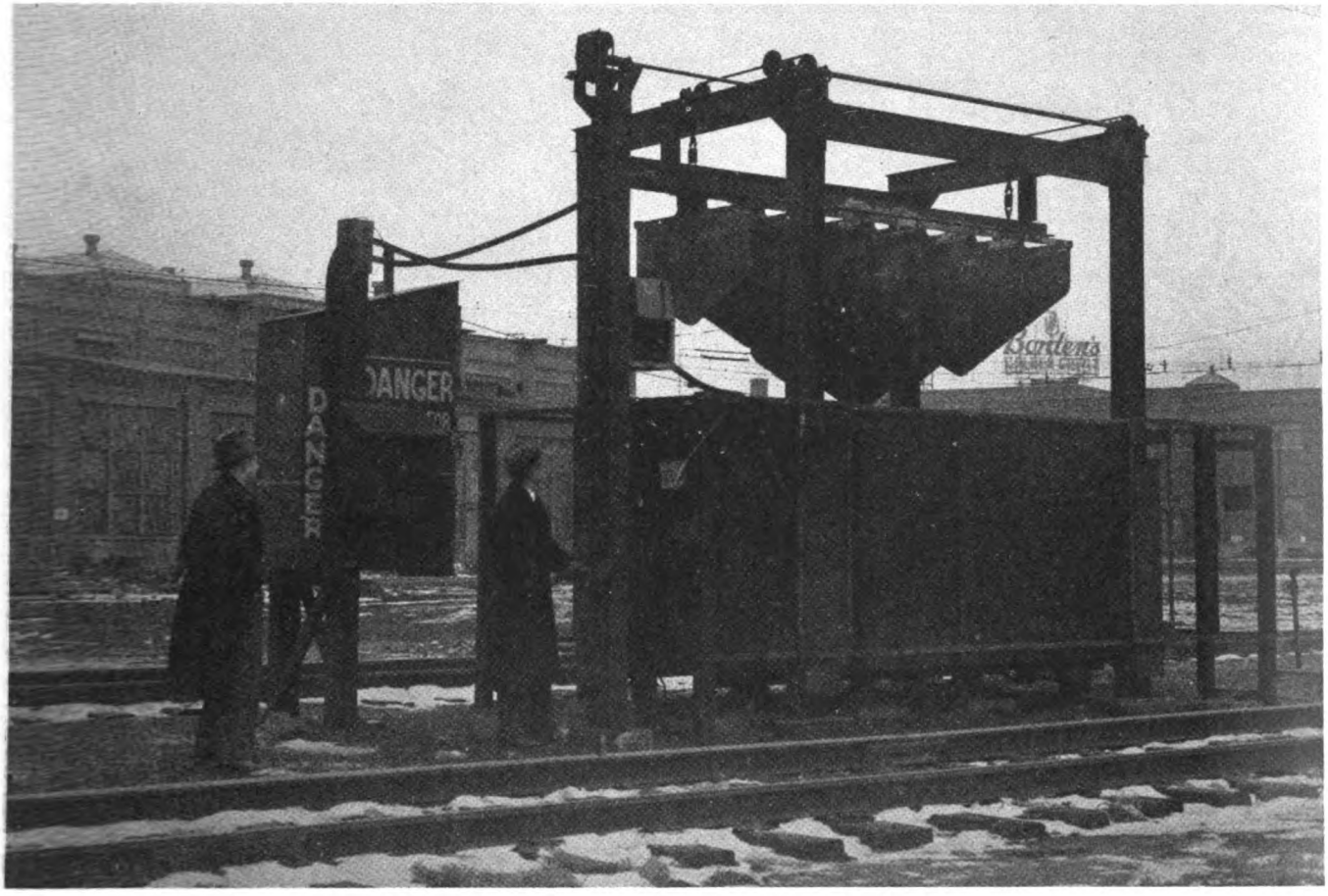
Air Motor Used in Drilling Crossbearers

A large car repair point was confronted with the necessity of manufacturing and drilling crossbearers for use in making heavy repairs to gondola cars. Machinery was available for forming these pieces but the drilling problem was not solved until the development of the drilling table and arrangement shown in the photographs. An air motor was set up in a fixed frame to operate horizontally. After having been laid out, a blank crossbearer is placed on the working table and is held in position for drilling by a drop clamping member which extends over the flange. The use of this device has contributed greatly to increasing speed in production and reducing costs per unit.



A rigidly mounted air motor serves to drill crossbearers rapidly and accurately

ELECTRICAL SECTION . .



General view of the rheostat with electrodes raised, showing the electrode suspension insulators, the circuit breaker housing and the terminal box. The man at the right is operating the hoisting mechanism —Insulators under the tank isolate rheostat from ground and permit the testing of locomotives equipped with ground detectors

Water Rheostat for Testing Diesel-Electric Locomotives

It is possible to measure engine output on a Diesel-electric locomotive by applying meters to read generator output while loading the locomotive with the brakes. This has distinct disadvantages because the load can be applied for only very short periods and is subject to fluctuations. It is frequently difficult to obtain enough track for making such a test and if the track is short there may be some hazards involved.

A much better procedure is to use a water rheostat such as the one shown in the illustrations. This was developed at the Van Nest shops of the New York, New Haven & Hartford. It stands at a convenient point in the yards; and to test an engine it is only necessary to place the locomotive on an adjoining track and connect the rheostat to the generator terminals by means of cables. A portable volt meter and ammeter are used to measure the generator output. The engine output and horsepower then equals volts $\times$ amperes $\times$ 0.001.342 $\times$ generator efficiency. Full engine load for any locomotive now in service can be maintained for any necessary time; and since the rheostat has ample capacity, troublesome bubbling or boiling at the electrodes is eliminated and a steady value of load can be held.

The rheostat consists essentially of a tank mounted on porcelain insulators and an insulated electrode which can be lowered to the required depth into the liquid in the tank. The tank, which is made of ¼-in. steel plate riveted, is 12 ft. long, 6 ft. wide and 5 ft. 4 in. deep. It is fitted with a 2-in. drain, a similar overflow pipe and is filled from a water connection or hydrant located at one end of the tank. In normal operation the tank is grounded, but the ground is removed and the insulators provide for the testing of certain locomotives equipped with ground detectors.

The movable electrode consists of an assembly of seven steel plates of varying lengths, each plate being cut to a V shape at the bottom. It is felt that very smooth increments of load are thereby obtained. The plate assembly, which hangs on two chains, is about 85 per cent counterbalanced and it may be raised or lowered by a hoisting mechanism shown in the drawings. This mechanism is self-locking and will transmit a slow movement in either direction. A fine adjustment is essential for accurate loading of the generator. The plate assembly is separated from the hoisting chain by porcelain insulators and the electric lead from the plate assembly is carried to a circuit breaker with an overload relay in a cabinet at one end of the rheostat and thence to a convenient terminal box mounted on the upright mem-

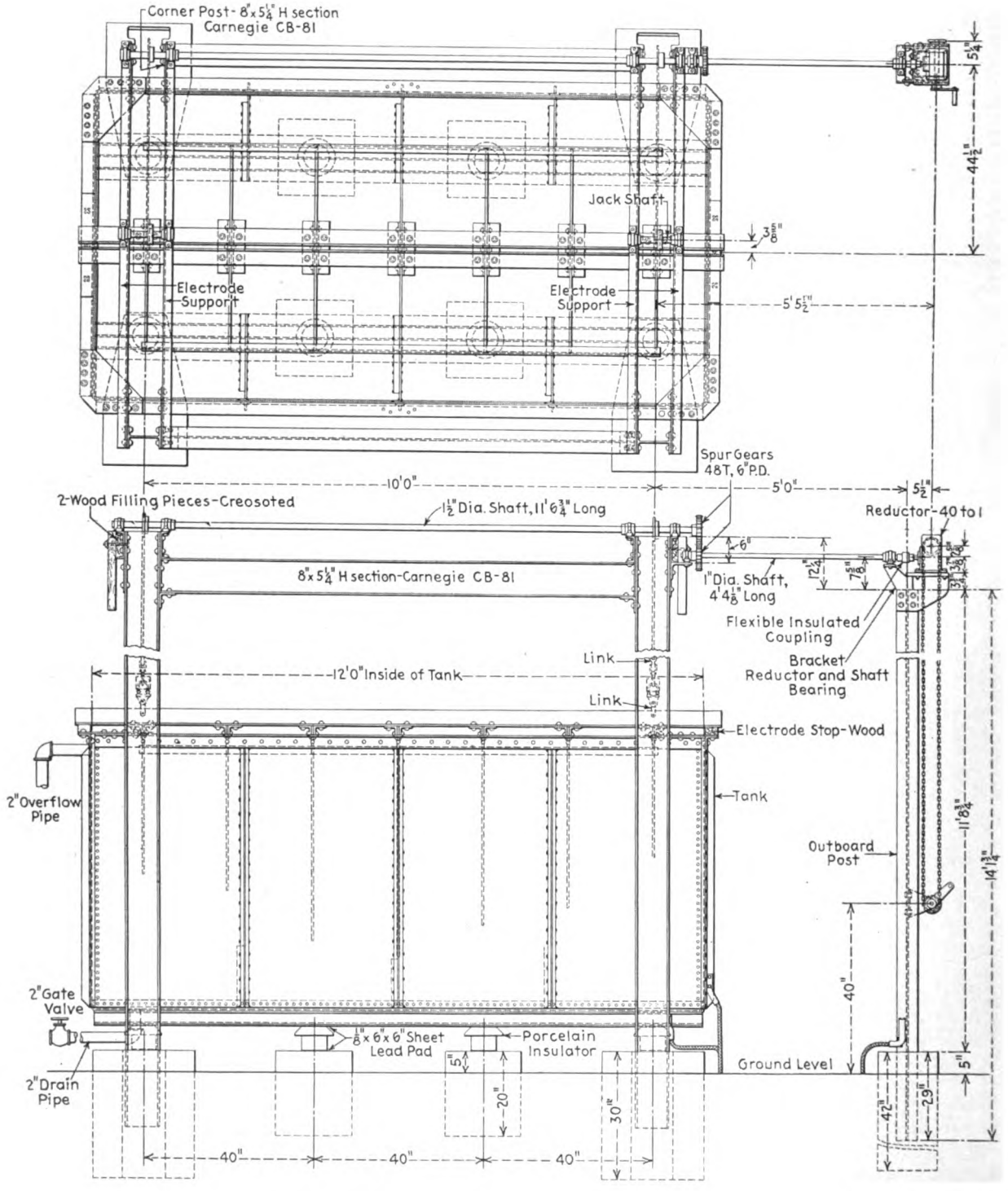
ber just above the hoisting crank. The circuit breaker is rated at 2,000 amp., 750 volts, d.c.

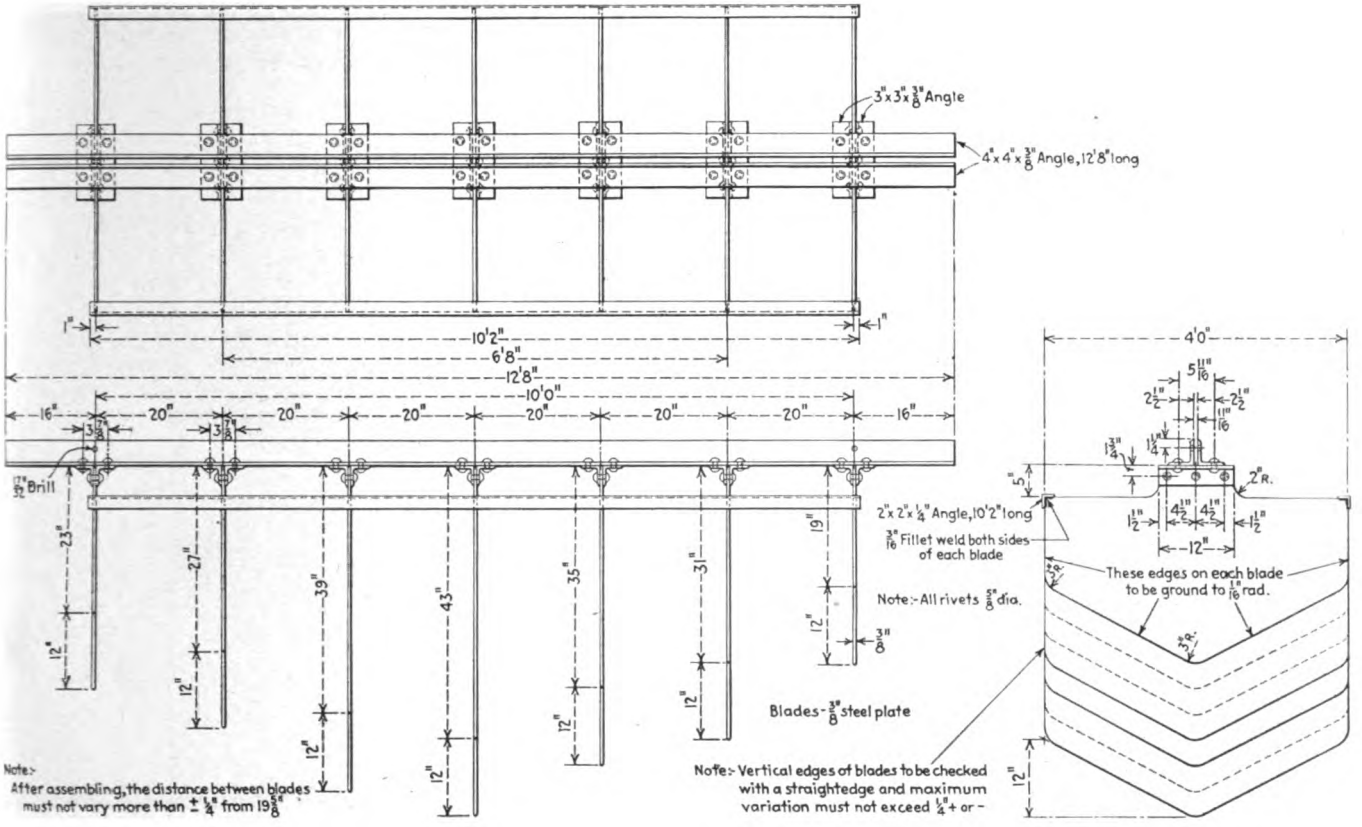
Instead of the highly corrosive sodium chloride usually used for liquid rheostates, the electrolyte in the tank is a solution of sodium carbonate of sufficient concentration to allow for applying full load to the engine when the greater part of the plates are immersed. A higher concentration would permit loading with only a small plate area immersed; but this would lead to boiling at the plate surfaces and cause an unstable load condition.

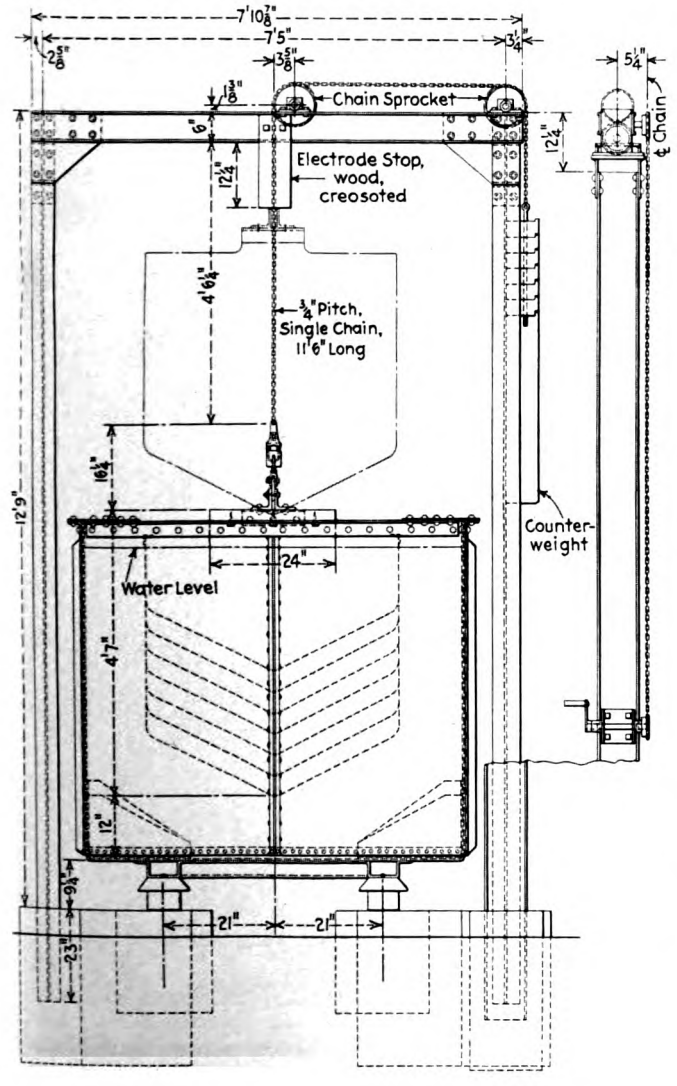
The rheostat can carry a load of 1,400 amp. at 714 volts. This load value was obtained with one of the railroad's motor generator locomotives, the rheostat providing the means for setting the exciter field on these straight-electric locomotives. Due to the all-metal construction of the tank and the resultant radiation properties, loads considerably in excess of this can probably be handled.

For the testing of Diesel-electric locomotives the rheostat has sufficient capacity for carrying full load output on a 1,000-hp. engine continuously. For the making of final load tests, the engine and generator are brought up to normal operating temperature which permits the making of all necessary adjustments. During tests, settings are made on relays and load control devices. The portable electric meters register load output while a maximum pressure indicator and exhaust-gas pyrometer and thermocouples are used to check Diesel-engine cylinder conditions. The rheostat is now used for switchers and will be used for road locomotives.

Plan and side elevation of the water rheostat







TOP: Plan and elevation of the plate assembly forming the movable electrode. LEFT: End view of the water rheostat showing the electrode plate assembly fully immersed and the large central plate in fully raised position

100-Watt Fluorescent Lamps For Passenger Car Lighting

A highly efficient application of fluorescent lamps in the form of four 100-watt, T17 lamps, operating with one ballast on a 277/480Y-volt circuit has recently been advertised extensively. Its principal advantage at the present time is the saving of critical war materials and power for war plant lighting. It has been suggested by L. Schepmoes, The Safety Car Heating and Lighting Company, New Haven, Conn., that there will be serious thought given to the use of similar lamps and ballasts in railway passenger cars after present wartime restrictions on fluorescent lighting are lifted. He suggests comparing the use of 100-watt and 40-watt lamps, by way of considering what advantages may accrue, other than the novelty of using something different for more decorative appeal. Such lighting efficiencies and savings in installation and maintenance costs as can be expected are indicated in the following:

On a basis of comparable lamp loads delivered by generator, let us take as our basis:

Four 100-watt lamps with ballast = 436 watts
Eight 40-watt lamps with Tulamp ballasts = 448 watts

With 42 lumens per watt for 100-watt lamps and 52 lumens per watt for 40-watt lamps, we have for efficiencies:

16,800 lumens ÷ 436 = 38.53 l/w for 100-watt output
16,640 lumens ÷ 448 = 37.14 l/w for 40-watt output

With present list prices of lamps and ballasts used for

comparing costs, we have initial investment per initial lumen output:

$20.60 ÷ 16,800 = $.0012 per lumen for 100-watt layout
28.80 ÷ 16,640 = $.0017 per lumen for 40-watt layout

The foregoing figures show slight advantage in efficiency of 100-watt lamps with considerable saving in initial cost of lamps and ballasts to deliver equivalent light output in favor of 100-watt lamps.

The 100-watt lamps are rated for 3,000 hours and the 40-watt lamps for 2,500 hours. List price costs and rated life of lamps give a rough estimate of $3.75 per car year saving in maintenance for 100-watt lamps.

Opposed to efficiency and cost advantages some disadvantages are indicated in using 100-watt lamps on 280-volt circuits in railway cars:

(a) Higher voltage requires heavier insulation and other precautions.

(b) Surface brightness of 100-watt lamps is about 13 per cent higher than 40-watt lamps. This additional glare can be absorbed by proper translucent shades but with some loss in lumen per watt efficiency.

(c) Special lamp sockets and special starters are required for 100-watt lamps, although the added cost of each is offset by the reduced quantities required.

There may be some tendency to claim the advantage of much higher foot-candle illumination obtainable from 100-watt lamps on the assumption that fluorescent lamps end to end in a continuous ceiling trough produce 840 lumens per foot with 100-watt lamps, compared to 520 lumens per foot with 40-watt lamps. Such increased foot-candle illumination necessitates an increase in lamp load wattage. It is also questionable whether more than 20 foot-candles, illumination from continuous 40-watt installation is desired in a railway passenger car.

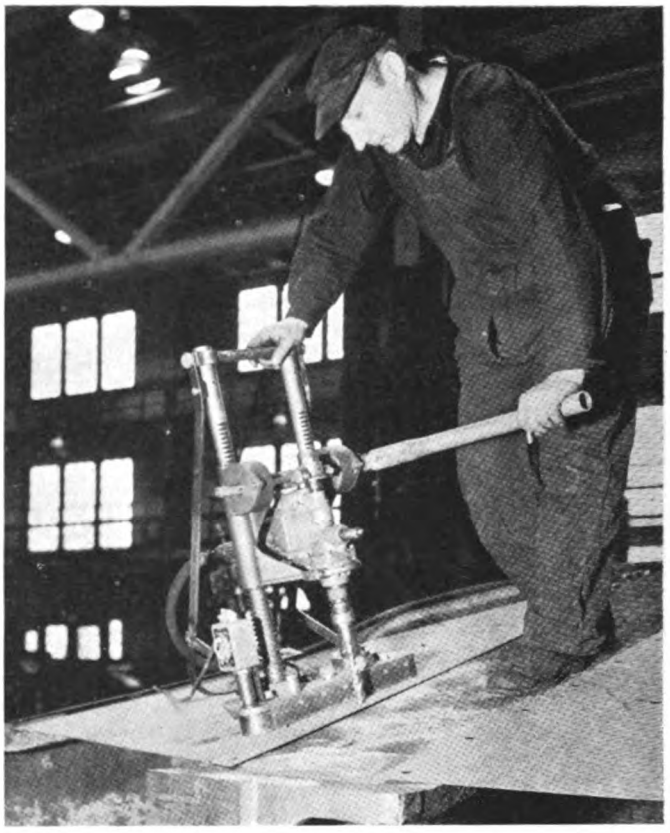
Magnetic Base For Portable Drill

A portable drill with an electro-magnetic base improvised to speed the job of drilling and tapping holes in large water-wheel generator frames and similar equipment in manufacture at General Electric's Schenectady, N. Y., works can also be used for counter-boring and countersinking. Holes in the generator frame, a 1¾-in. casting, are drilled and tapped at an angle, using the holes already drilled in 3/16-in. cover plates for templates. One man can set up and perform the operation easily.

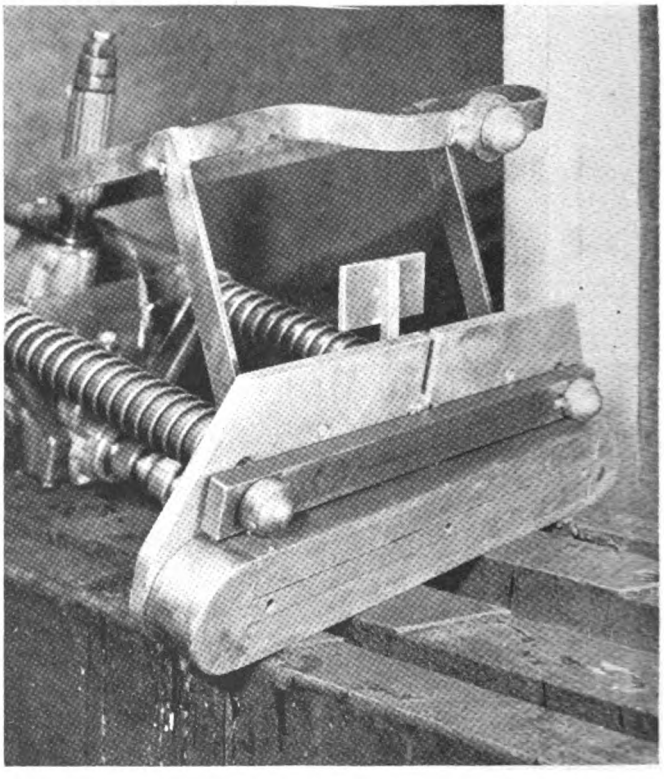
The tool is simple to make. It consists of a railbonding drill frame altered to make it a reversible multivane drill. A third leg added to the frame provides stability. The drill is fitted with a taper socket and a quick-change chuck to speed the changeover from drill to tap, since once the drill is positioned the hole is drilled and tapped without disturbing the setup. The drill is ratchet fed.

The electro-magnet used will exert a force of about 500 lb. on material with a minimum thickness of 3/16 in., and equal force on material of greater thicknesses. An air gap of 10 mils between the poles of the face plate and the cover plate compensates for irregularities on the cover plate surface. The magnet operates on 120 volts and is energized and de-energized by means of a toggle switch conveniently located on the frame. A foot-treadle is used to lower the magnet to the work and to raise it for repositioning the drill. When the magnet is in the raised position, the three-legged frame can be moved about easily on its ball casters.

A solenoid-operated air valve between the air source and the drill keeps it inoperative unless the magnet is energized. Thus, if power on the drill is lost, the chance of possible damage to the tool or operator is eliminated. The valve is wired in parallel with the switch and on the magnet, or load side, and is normally closed.



Air drill and magnetic base in operation—The toggle switch is shown at the front and the releasing treadle is on the side of the magnet opposite the drill



Bottom view showing magnet and ball casters—pressure on the treadle lowers the casters and raises the magnet breaking the residual pull

Electrician Solves Transportation Problem

The rubber and gasoline shortage have not kept A. H. Matthews, electrician, from reaching the Canadian National's Quebec shops regularly and on time, although he lives twelve miles away, at Lake Beauport. He has solved his commutation problem with "Electra", the snow-mobile shown in the illustration.

The body is 5 ft. long and 24 in. wide at the center, has a spruce frame and is covered with 2-ply-wood. It



The snow-mobile, "Electra", which has fulfilled A. H. Matthews' commutation requirements. A windshield has since been added

rides on three skis or runners (3 point suspension), two at the rear and one at the front which may be turned by means of a steering wheel inside the body. The two rear runners are each 6 in. wide and 48 in. long. The steering runner is 6 in. wide and 36 in. long.

Motive power is derived from an electric motor directly connected to a 36-in. laminated straight grain white birch propeller, one blade of which may be seen in the illustration. Power for the motor is derived from a 12-volt battery. The motor, suspended in a cradle back of the driver, is a series wound machine which was found on a junk pile and purchased for $5.

When asked for information, the designer replied that the motor is 8 in. in diameter, 16 in. long; that its original voltage is doubtful and that it draws 90 amp. on a 12-volt battery, while driving the propeller at 3,000 r.p.m. or more. The 1 in. shaft between the motor and the propeller runs on ball bearings.

Electra's speed on ice, with steel runners, is given as 32 to 75 m.p.h., on hard packed snow as 25 to 45 m.p.h., and on soft drifted snow as 10 to 25 m.p.h.

The motor is driven by two 6-volt, 120 amp.-hr. Willard storage batteries, connected in series. Two other similar batteries are carried in case of need. The distance which can be travelled depends upon road conditions and the velocity and direction of the wind. With a following wind there is plenty of power left in a 12-volt, 120 amp.-hr. battery after the 12 mile run. With heavy snow, it is a case of "get out and push" uphill. Also when the snow is heavy, the second battery is substituted for the first one, at the 6-mile point. This is accomplished by transferring a pair of spring clips from the terminals of one battery to the other. The motor is started and stopped by a single-pole, single-throw switch. Braking is effected by a hand lever which lowers an iron hoe blade to the ground, at a point between the rear runners. The batteries are charged at both ends of the run. Electra's weight complete is 140 lb.

The propeller and the three runners, purchased from the Lorenzen Propeller Co., Niles, Mich., represent a total cost of $31.19. The four batteries were $40, and the motor $5. The total cost was thus $76.19, plus a small amount for spruce framing and ply-wood.

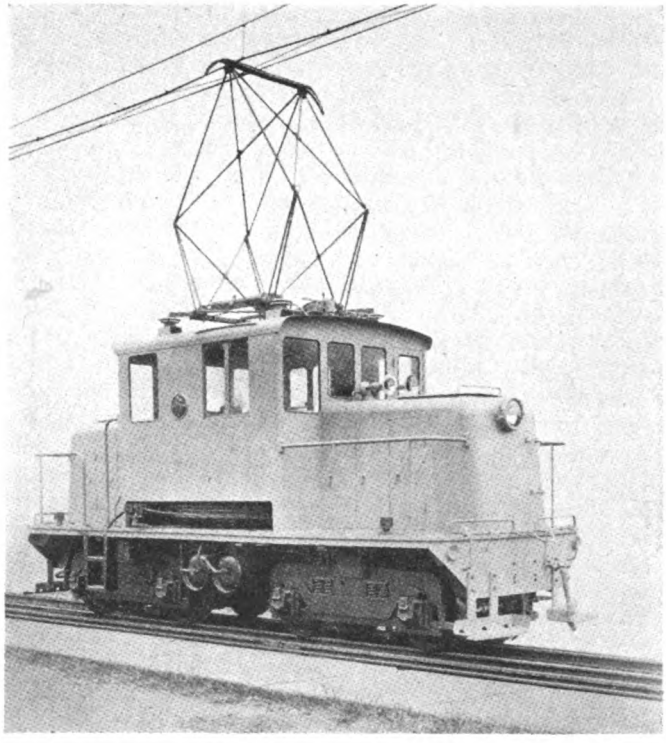
It is the designer's intention to put wheels on Electra for summer operation.

Chile Receives Electric Locomotives

Nine locomotives such as shown in the illustration, together with two complete spare trucks, were shipped recently from one of the General Electric Company's eastern plants to Port of Export for use in the mines of Cla. Salitrera de Tarapaca y Antofagasta, Iquique, Chile. These 40-ton locomotives were built to operate on meter-gage track from a 500-volt, d.c. overhead trolley.

Each locomotive is equipped with four 75-hp. motors with forced ventilation and single-station, full-magnetic control with dynamic braking. Power is collected by pantograph on the main haulage line and by means of an electric-motor-driven cable reel equipment having 4,200 ft. of single conductor cable.

The successful operation of other Chilean Nitrate's properties led to the modernization of methods at this mine, together with the adoption of electric haulage. With this shipment, the number of G.E. locomotives of approximately this weight shipped to the Chilean Nitrate fields will be 70.



The reel and cable under the cab are used to permit operation beyond the limits of the overhead wire, particularly on ladder loading tracks

Water in Conduit Systems

Some time ago we installed a conduit system in an enginehouse which we tried to make as tight (moisture-proof and vapor-proof) as possible. As soon as cold weather came on, all the low places filled with water and we had to drill holes to let the water out. What is the best way to take care of a situation like this?

Precautions Prevent Trouble

Moisture-proof and vapor-proof conduit systems must be carefully designed and installed in order to obtain satisfactory, trouble-free installations. It must be remembered that the conduits, boxes and fixtures, etc., enclose a volume of air of the same relative humidity as the surrounding atmosphere. This air is trapped when the system is sealed and thereafter cannot gain or lose moisture if the job is installed perfectly tight. The temperature of this trapped air, however, will vary with the surrounding ambient. When the temperature falls below the dew point of the trapped air, it will drop its moisture in the form of condensation on the inner walls of the conduit system. The resulting water will collect, if of sufficient quantity, at all low points in the system. When temperature falls below 32 deg. F. this trapped water will freeze, causing damage to both conduit and cables.

This condition should and can be avoided by carefully designing the conduit system with a liberal slope (6 in. per 100 ft.) so that all condensation will drain out of the conduit to a box. No box should be located where it may become filled with water. As soon as water collects in a box to the height of an outgoing conduit which runs to a lower box, the surplus will flow to that box. The layout should be so co-ordinated that all moisture will be collected at a few low points. It is advisable to install an additional drain box below each outlet box at these locations. In this manner, wires and devices in the lowest outlet box will never be submerged. The drain box can be provided with a plug which is removed whenever sufficient water has collected. It may even be desirable to keep the cover off this box during certain periods when condensation is most prevalent.

Although the simplest and cheapest way of removing condensation is to drill holes in the conduit at the low spots, the method is quite crude and may result in damage to the cables which may be cut by the burr on the interior wall resulting from the drilling. All corrosion resisting material has been removed by drilling and much more rapid deterioration will result at this point, particularly in view of the fact that all condensate will flow through at the very spot with the least protection. A somewhat better way of doing the same thing is to use a plumber's tee fitting as a coupling at the low point. The leg of the fitting is set facing downward and acts as the drain.

Where water will collect in outlet boxes, the simplest way to drain the condensate is also to drill a hole in the cover at the low point of the box. This defeats the primary purpose of the tight conduit system as it permits breathing of the air within the system. This means that the injurious fumes or vapors which the layout is designed to exclude will be drawn into it every time there is a change in temperature, defeating its very purpose.

Probably the best arrangement for draining a raceway system is to run conduit from the lowest boxes to points outside the area in which the moisture-proof conduit system is required. Leave the end of this small conduit open at all times. A box may be installed at this location if desired to improve the appearance if this is a point which must be considered. The cover should be provided with a weep-hole.

Special precautions should be taken where conduits enter panel-boxes. It is preferable that they enter from the sides when they come from outlet boxes located at levels above the panel box. By following this arrangement, all condensate draining in from these conduits will flow down the sides of the panel box and will not drip from the top upon switches, cutouts or other devices mounted therein. If a drain conduit is not installed, at least one conduit should be run from the bottom of the panel box to carry off any accumulation of water. Drainage should then be provided at the lowest box in the system as mentioned above.

All wires entering the panel box from top or sides should be provided with drip loops where all condensate will be shed before coming into contact with splices or exposed conducting parts. This will prevent creepage and corrosion which in time will undoubtedly cause trouble.

Where vapor-proof lighting fixtures are installed in such a system, care should be exercised to ascertain that water will not collect on current carrying parts of the socket or fill the glass enclosing globe. Pendant type fixtures should be installed where possible, the upper end of the stem being sealed to prevent water entering from the outlet box and finding its way down into the globe.

STANLEY A. KROLL,
Electrical engineer.

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York, N. Y.

Can you suggest ways and means of improving the performance and increasing the life of endless V-belt drives such as are used for railway-passenger-car, air-conditioning compressors?

Various Wiring Systems May Be Used

Since the inception of the conduit system of electrical wiring, problems of condensation have appeared, especially in southern sections. The amount of condensation varies with the moisture content and temperature of the air. Warm air can keep more moisture in suspension than cold air and, when chilled, this moisture is precipitated and dew is deposited in the conduit. Moisture is known to be one of the worst enemies of insula-

tion and the conductivity of water increases as it is contaminated with dirt and chemicals, such as present in an enginehouse.

Vapor-Proof System.—The accumulation of water in conduits may be reduced to a satisfactory extent by the use of well-sealed moisture-proof and water-proof electrical fittings. This is, however, an expensive way of remedying the objectionable condition. In the present case, it would seem that the system is "breathing" at some point or points. A close inspection of all mechanical connections should be made to stop air circulation through the conduit. All conduits should be run, wherever possible, in dry places and where the temperature variation is a minimum.

Inverted Wiring.—In sections where there is possibility of severe condensation, the conduit system should preferably be distributed in such a way as to prevent the formation of water pockets. Where properly designed conduit tunnels or floor channels are not available for under floor access to the conduit system, branch circuits can be distributed from an overhead distribution panel with conduits running down into junction or outlet boxes and allowing evaporation or seeping out of the collected moisture deposits.

Drained System.—Where conduit tunnel or under floor space is available, conduits may be run in that space provided junction boxes are placed at all points where collection of water may be expected. These junction boxes should be installed without cover gaskets and made generally non-watertight to permit seepage.

Where neither of the two foregoing methods are applicable and a conduit has to be run U-shaped creating a water pocket, one or two "weep" holes are drilled at the lowest point of the conduit run. The second hole is provided as a measure of safety against clogging of the other. Where excessive moisture troubles exist, lead covered wire or the new low absorption wire may be used in addition to the foregoing measures. In applications where exposure to the sun or periodic high temperatures cannot be avoided, the new high-heat rubber covered wire should be used.

Sealed System.—In an existing conduit installation where stamped steel fittings have been used and the foregoing methods of draining cannot be applied the conduit run collecting water is blown out thoroughly, dried and then sealed at both ends. A satisfactory method of sealing consists in loosely caulking the conduit ends with wires protruding and then sealing with heavy pothead compound heated to the proper pouring temperature.

R. G. CAZANJIAN
Supervisor,
Triborough Bridge Authority,
New York

Why Use Conduit?

There is no practical method of keeping moisture out of conduit. The alternate heating and cooling of the cables due to fluctuating load will draw in moist air which condenses and collects in the low spots.

A method which has been used satisfactorily by at least one railroad is to install without conduit a cable with a synthetic jacket to give mechanical protection as well as corrosion resistance. A copper shielding tape may be applied under the jacket to give ground protection. This not only eliminates trouble from moisture condensation, but also eliminates the problem of conduit corrosion which is so serious where coal smoke and moisture are present in combination. An earlier installation where open wiring has been used was described in Railway Electrical Engineer, April, 1937. In this instance, braided cable was used, but a synthetic jacket, such as Flamenol, will give better corrosion resistance.

A second method would be to install the conduit run at a slant so that there is only one low spot. All moisture runs to that spot where it may be drained.

On a conduit line already installed, drilling holes in the low spots is about the best solution. These holes would probably soon become clogged, however, and this would necessitate periodic checking. If a tee were inserted in the conduit at each low spot, and a trap attached to the tee, an effective drain would be provided which at the same time would provide a seal.

L. D. MADSEN
Central Station Engineering Dept.
General Electric Company
Cable and Wire Section

The Best Conduit System Will "Breathe"

The best way to keep moisture from collecting in a conduit system is to provide a means of draining the system. Perhaps the easiest way to do this is to drill a small hole at each of the low points of the system. Conduit fittings and conduit threads are not intended to be water tight. Therefore it is next to impossible to make them water tight in the first place, and it is a hopeless job to maintain them in a water tight condition. The best that can be done is to make sure that water is not introduced into the system by being allowed to drip into an open condulet, or by following a wire down through a weatherhead. If possible a conduit system should always be installed like the letter *A*, and not like the letter *U*. The former will drain while the latter will not, unless a drain hole is provided at the bottom of the loop.

All conduit systems are filled with air, and all air contains a certain amount of moisture. The question stated that the low point of the conduit system filled with water when cold weather came. Let us see what happened. The conduit may have been installed on a warm summer day, when the humidity was high—that is when the air contained a large amount of water vapor. This moist air was sealed into the conduit system. Then when winter came and the temperature dropped, and the moisture inside of the conduit system condensed, with the result that water was formed within the conduit even though no water had been introduced from without. In most conduit systems, however, water gets into the conduit by the process known as "breathing." We all know that air expands when it becomes heated, and that it contracts when it becomes cold. Thus, if the air inside a run of conduit becomes hot, a pressure is generated with the result that some air is forced out. When the temperature drops and the air contracts, some outside air is sucked into the conduit. Each time this happens a little moisture is introduced.

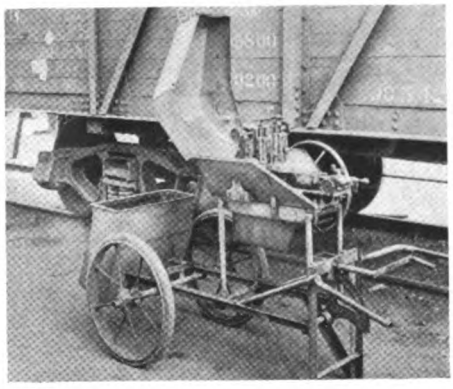
Designers realize that conduit systems can not be made air tight. Explosion-proof conduit fittings are not made air or gas tight even when they are intended to be used in an atmosphere which will contain explosive gases. It is realized that gas and air will "breathe" into and out of the system regardless of what is done. Explosion-proof fittings, therefore, are made strong enough so that any dangerous gas which does get into the fitting can explode within the fitting or conduit without causing explosive gases outside of the fitting to explode.

A. R. BASSET.

Materials Saved By Car-Brass Trimmer

Extensive experience seems to prove that copper, tin, lead, zinc and antimony, or all critical materials used in journal bearings, can be saved in substantial quantities by American railroads through more extensive use of the car-brass trimming machine which was developed by the Journal Box Servicing Corporation, Indianapolis, Ind., in 1937 and has since been improved and thoroughly tested on a number of railroads in different parts of the country. An article referring briefly to the performance of this machine was published in the January, 1940, issue of *Railway Mechanical Engineer*.

The car-brass trimmer is a portable



Portable car-brass trimming machine with the hood lifted and shaper raised, ready for operation

hand-operated shaper designed to trim the edges of journal linings and reshape the original oil grooves on bearings that might be replaced, as well as those in a partially over-run condition. The machine consists of a small double-head, hand-operated shaper which has a special chuck for holding the brass, and cutter heads and tools with cross and vertical hand feed. The shaper is mounted on a steel frame which is carried on two 26-in. rubber-tire wheels with handles on the front for convenience of moving the machine about the shop. A hand-operated worm gear and quadrant permit lowering and retracting the heavy part of the machine and a hinged metal cover protects it from the weather when not in use. A sheet metal box at the rear provides carrying capacity for spare brasses. In general this machine is designed for movement to any point on the repair track where a truck is being repaired or a journal repacked. The work of trimming the lining edges and reshaping the oil grooves is done in from one to two minutes when the bearing is removed for inspection and it is then returned to the same journal on which it was run-in and has a full seat.

The possible saving of critical materials as well as improvement in journal lubricating conditions is evident from a brief review of railroad practice which permits turning down surface-marred and cut journals until ½ in. less than the original diameter before scrapping. New journal bearings, made with a fixed radius slightly greater than the radius of the full size journal, are applied to journals that have been reduced in radius by turning, thus producing a bearing fit of very limited area. To compensate for this great tolerance a lining metal of soft lead-base is applied to bearings to enable them to correct as quickly as possible the imperfect fit by the soft lining adjusting itself to the contour of the journal.

Unquestionably the break-in period is often responsible for hot boxes because when a new bearing is applied to an undersize journal the load is estimated often to be as great as 2,000 lb. per sq. in. of bearing area, while a fully seated bearing carries only about 400 lb. per sq. in. maximum. In the process of conforming the babbitt lining to the contour of the journal it has been found that the babbitt flows at the bearing edges, thus restricting proper circulation of the oil; also, the oil groove on each side of the bearing is frequently closed at the center, due to shocks received in service. As a result such bearings operate at temperatures so high as to cause failures in service.

A. A. R. Interchange Rule 66, Par. j. calls for the renewal of journal bearings, "when lining is spread over side ⅛ in. or more below bottom edge of side wall of brass, either side, regardless of length of such spread." This rule is generally interpreted to mean, when the lining is spread ⅛ in. below a straight line across the bottom of the shell of the bearing, whereas what was probably meant by "bottom edge of side wall" was the bottom edge of the lining at the top of the oil groove. The reason for this assumption is that the spreading of the babbitt sufficiently to fill the oil groove, or reduce its width, is almost as damaging as if it extended ⅛ in. further. If the babbitt extends below the straight line, lint wipers will build up under the edge of the over-run babbitt.

The theory underlying advantages secured by eliminating over-run bearing edges and especially restoring the oil grooves is well illustrated in the drawings which show (at the left) the edge of a bearing in contact with a journal on the rising side. The bearing is fully seated and has been trimmed with the brass trimmer. It will be noted that as the journal carries the adhering oil containing particles of fine lint to the bearing; the excess is wiped off and clings to the outer edge of the oil groove, swings to under-side of the bearing, and forms in drops along the full length of the bearing where it drips back into the packing, free of the rising journal.

This drawing also shows (at the right) a fully seated bearing with the babbitt lining spread at the edge. The extended babbitt, and lack of oil groove, prevents the excess oil from swinging out onto the bearing away from the journal. Gravity causes it to run back down the rising journal which carries it back to the bearing. The hot oil pools up along the edge of bearing and journal and, as more oil is brought up, it overflows at the back end of the bearing, and is carried on to the larger diameter axle by centrifugal force and thrown onto the wheel. The lint in the oil, lacking the flow to carry it on, drifts under the overhanging babbitt, causing a "wiper."

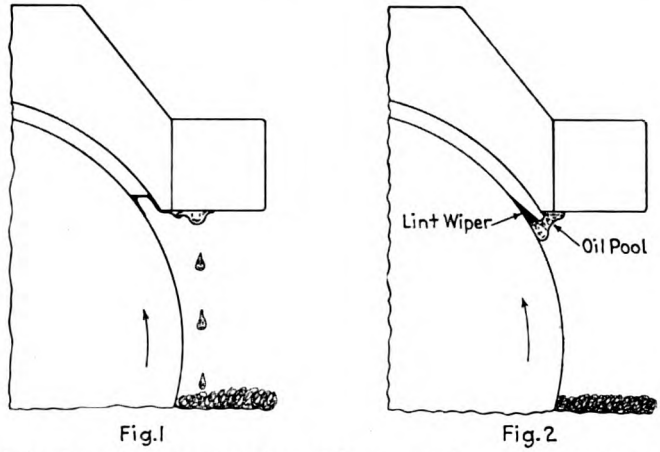
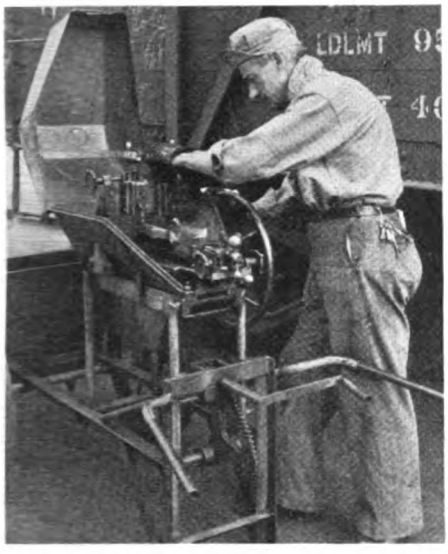


Fig.1 Fig.2

Left: Properly trimmed car-journal brass, cooled by oil which carries fine lint back to the packing without contacting the journal—Right: Over-run brass with oil and lint building up along the edge of the bearing—This is a potential cause of a hot box and of the loss of oil out of the back of the box

The principle of maintaining a fully

run-in bearing on its original journal is borne out by the practice of an automobile mechanic adjusting the connecting rod bearings of an automobile. As each cap is removed he is careful to mark it to be sure that each cap is returned to the same bearing. The caps are all alike and can be interchanged, but the mechanic knows that to mix them up is to invite disaster. Therefore, he returns each cap to its original station. Car journal bearings, trimmed and returned to the same journal, will not again



Method of operating the car-brass trimmer to remove over-run babbit and cut new oil grooves

run over, and should continue to operate until worn out, with only a yearly touching up required to remove the effect of slight upsetting due to blows caused by bearing lifting from journal in heavy switching, etc. Trimmed bearings are said not to accumulate lint wipers, as is the case with over-run linings.

Trimmed bearings also should not develop cracked or loose linings, which are caused by excessive temperatures due to over-run linings and lint wipers. This supports observation over a number of years, which has proved that cracked linings are caused by excessive heat, usually as a result of lint wipers along the edge of the over-run babbitt. The wipers cause a bright streak across the face of the lining due to stopping the flow of oil at that point. The increase in temperature at that part of the lining may reach a point as high as the melting point of solder (380 deg. F.) with which the lining is bonded to the bearing. This may cause the lining to loosen from the back at the point where melting occurs. Subsequently the motion of the metal in the loose spot causes the cracking. The melting point of the babbitt lining is approximately 500 deg. F., hence it does not melt.

Exhaustive service tests of bearings reconditioned by the use of the car-brass trimmer show that not only are journal bearings saved but improved lubricating conditions result. The record of a single machine on one railroad in the Middle West was kept for a period of one year in which 5,557 cars were repacked and 44,456 journals inspected. The following results were recorded: (a) Number of brasses found O.K., 11,556; (b) Number of brasses trimmed and saved that would have been scrapped if the brass trimmer had not been available, 8,504; (c) Number of brasses partly over-run, which were trimmed to improve their appearance, 23,420; (d) Number of new brasses actually applied, 976. The sum of (b) and (d) represents the number of brasses that would have been scrapped except for the brass trimmer, or 9,480 brasses which represents normal replacement. Of this number 8,504 brasses were saved or 86.4 per cent of normal replacement.

Similar records for the use of a number of car-brass trimmers on a Southern carrier are as follows: Cars packed, 33,252; brasses trimmed to save, 85,454, or 2.57 per car; brasses trimmed to improve, 110,256, or 3.31 per car; brasses found O.K., 48,238, 1.46 per car; brasses replaced with new, 22,068, or .66 per car; total brasses inspected, 266,016.

The procedure of trimming a perfectly sound brass already seated to the contour of the journal, but with the lining spread over the side wall of the bearing, is simple. The actual time required, from the moment the bearing is removed, trimmed and reapplied to the same journal, is said to average between one and two minutes. The cost, in which rental and labor is computed, will average between two and three cents a brass.

The total amount of iron and steel involved in the manufacture of a brass trimmer is approximately 250 lb. Reports indicate that each machine has saved the replacement of 120,000 lb. of new or relined bearings annually and this, in turn means that it would have been necessary to add at least 3,000 lb. of new critical material stocks, of copper, zinc, lead, tin and antimony.

Magnetic Inspection Equipment

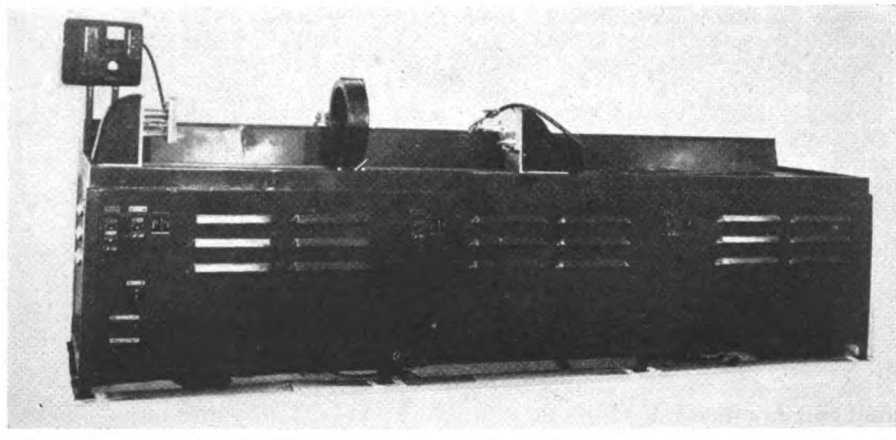
Magnetic inspection units bearing the trade name "Ferroscope" are being offered for use in railroad service by the Western Industrial Equipment Co., Los Angeles, Calif. The unit shown is made in six sizes, to test parts ranging from 4 ft. to 10 ft. 6 in. in length. The cabinet houses the batteries, charger, magnetic switch with time-relay control, and a circulating pump. The tailstock at the right is also motor operated. The current required is 110-volts, 50-60 cycles.

The part to be tested is clamped between the tailstock contact plate and the spring-loaded headstock. It is then sprayed with a solution of ferrous oxide and the current, which may be controlled over a range of 0 to 500 amp., is run through the part for about ½ second. A concentration of the oxide will cling to the outlines of any surface cracks and also will adhere to points above hidden defects, such as blow holes, non-metallic inclusions, faulty welds, etc. Excess solution drains into a sump, from which it is returned to the pump. The demagnetizing coil shown between the head and tailstocks operates on alternating current and may be made with an opening at one side to avoid the need of sliding it over the test pieces.

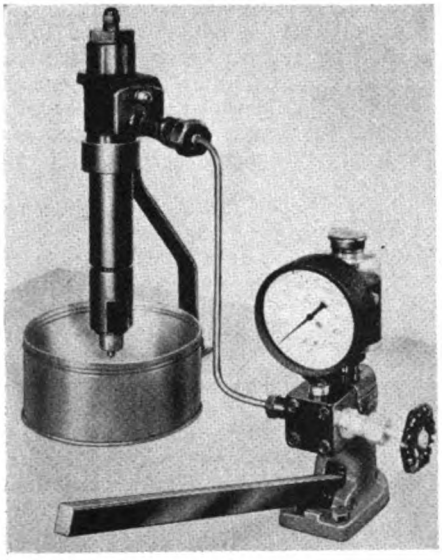
Diesel-Engine Fuel-Nozzle Tester

The satisfactory operation of railroad Diesel engines, like those used in other industries, is dependent upon some means for the easy testing and adjustmnt of fuel injection nozzles, since defective nozzles not only impair engine performance but tend to cause the formation of carbon on the valves, cracked pistons, etc. To facilitate maintaining Diesel engines at peak operating efficiency, the Aircraft & Diesel Equipment Corporation, Chicago, has developed a portable nozzle tester, Model PH-24, especially designed for testing Diesel nozzles and other devices subject to high liquid pressures. The tester is precision built, weighs only 8½ lb. and is hand-operated by an easily removable handle. It is designed to produce pressures up to 10,000 lb. per sq. in.

Features of the original Model PH-22 Adeco tester include a suction valve construction which is said to be free from air troubles; a shut-off needle valve which prolongs the useful life and accuracy of the



Flaws are detected by magnetizing the piece to be inspected and then applying a solution of ferrous oxide



Diesel fuel-nozzle testing device

hydraulic pressure gage by disengaging the gage when the device is used for leakage tests and readings are not required; and a heavy-duty hydraulic pressure gage. Features of the PH-24 tester include push-button priming which facilitates starting with a dry unit and the provision of valves of unusually durable construction which will stand up under heavy clamping without distortion.

The Adeco tester is designed for checking all sizes and types of fuel injector nozzles by means of standard adaptors which may be supplied as required. It may be used as a portable unit for checking injectors on the engine or with equal efficiency as a permanent test-bench installation. The portable feature is especially valuable since injectors which test OK at the bench sometimes fail to function properly after installation, due to sticking nozzle valves caused by the deformation of valve parts under heavy clamping. The use of this tester permits quickly discovering such defects directly at the Diesel engine.

Bullard 74-In. Vertical Turret Lathe

One of the developments of the Bullard Company, Bridgeport, Conn., brought about in part by war production work and which the railroad shop can take advantage of is the 74-in. Cut Master vertical turret lathe. The smaller sizes of this type of machine, from the 30-in. to the 64-in. capacity, were described in the *Railway Mechanical Engineer* for October, 1939, page 414, but production on these sizes was halted because of government restrictions.

The capacity of the 74-in. machine, with the side head in the working position, is 78 in.; with the side head below the table top the maximum capacity is 82 in. Within this capacity range, for example, fall about 80 per cent of all the wheel centers and tires used on American railroads. This model has six head combinations involving the use of the ram, side and turret heads. A swiveling turret or ram head, right or left hand, is standard equipment with the screw feed and has rapid power traverse in all directions. These may be supplied with the original machine or added at any time as a standard unit, with the feed works. The turret head is 18 in. in diameter with five faces having 2¾-in. tool post holes. With a vertical movement of 30⅜ in. it will face to full machine capacity and swivel 30 deg. right or left of center. Both right- and left-hand ram heads have 3⅜-in. tool post holes; a vertical movement of 30½ in. and will swivel 30 deg. right or left of the center. The horizontal movement of the right-hand ram head is 42⅞ in. with 7½ in. additional past center while the horizontal movement of the left-hand ram head is 46⅞ in. with 1½ in. additional past center. The side head is standard equipment as a right-hand head and has power traverse in all directions. It has a square turret of 5½ in. for 1¼-in. by 1½-in. tools; a 62-in. vertical movement and 27 in. horizontal. The distance from the top of the table to the underside of the slide is 52⅝ in. maximum and the maximum turning diameter is 78 in.

The table speeds vary from 3.29 r.p.m. to 120 r.p.m. in the high-speed range with a pulley speed of 1,244 r.p.m.; in the standard range, from 2.46 r.p.m. to 90 r.p.m. with 934 r.p.m. pulley speed and in the low-speed range the table speeds are from 1.65 r.p.m. to 60 r.p.m. with a pulley speed of 622 r.p.m. There is an optional speed range of 1.24 to 45 r.p.m. with a pulley speed of 466 r.p.m. All of the speed changes are effected by two ball shift levers to the right of the machine.

There are 16 feeds in geometric ratio, with independent feed works for each head. The vertical and horizontal feeds are so designed that they may be engaged simultaneously to give a 45-deg. resultant feed in any quadrant. The same is true of the rapid power traverse. The feeds range from .0026 in. to .500 in. and are the same for all heads.

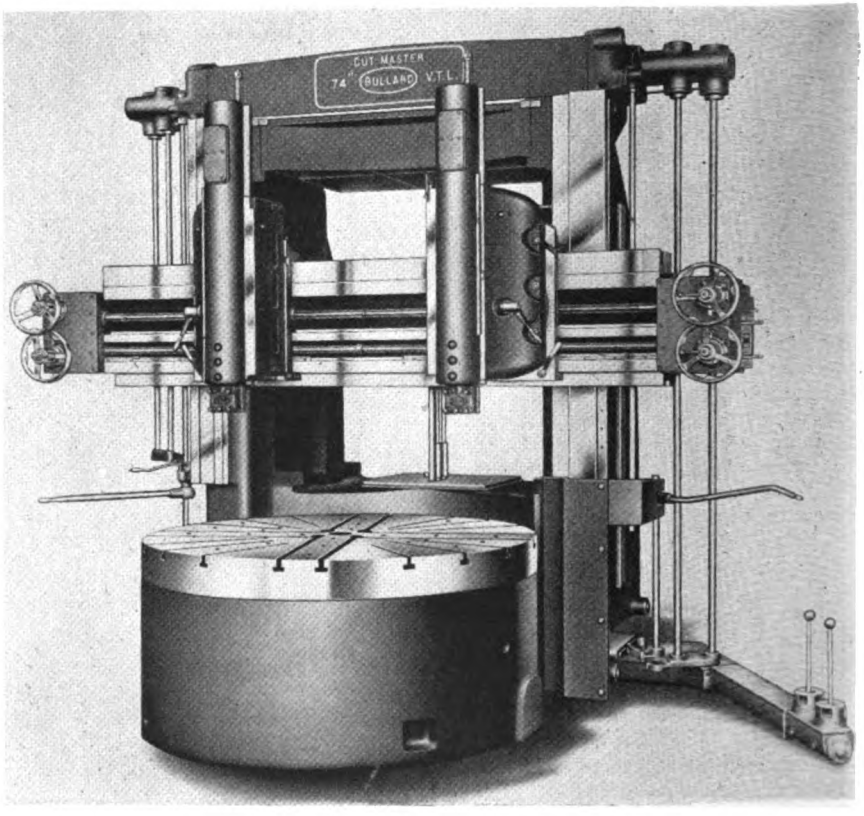
The motor drive is by means of a V belt. A floor mounted motor is recommended although side bracket mounting can be supplied. The electrical controls are supplied as part of the machine equipment. The cutting lubricant system is also supplied with the machine. The T.D.A. unit—thread cutting, drum scoring, angle turning and scroll cutting—can be applied to turret, ram or side head.

The maximum projected floor space required, without cutting lubricant system, is 132 in. by 178½ in. and 170 in. high, the width depending on whether one or two heads are used on the rail. The approximate net weight of the base machine and cross rail is 52,000 lb. The turret head and feed works adds 3,700 lb.; the right- or left-hand ram head and feed works, 3,300 lb. and the side head and feed works 6,800 lb. The T.D.A. unit weighs 350 lb. These weights exclude the cutting lubricant system.

Dust Respirators

The American Optical Company, Southbridge, Mass., has developed an air-filtering cartridge for use with its type R-1000 respirator. This AD cartridge protects lungs against a combination of all kinds of dusts, including toxic, pneumoconiosis-producing, and nuisance dusts. Seven respirator cartridges have now been designed for inter-

(Continued on next left-hand page)



A Bullard 74-in. Cut Master—boring-mill type



RIGID INSPECTION

was Necessary to Establish the Phenomenal 1942 Railroad Record!



Rigid and regular inspection was necessary to handle the greatest volume of freight ever carried by the railroads.

Chilled Car Wheels aided in this inspection program because all chilled wheels are rigidly inspected and tested before delivery to the railroads.

Every Chilled Car Wheel is given the above six rigid tests in each of our 46 foundries, thus assuring absolute uniformity. Chilled Car Wheel inspection practices tie in with the rigid railroad inspection program and will again aid the railroads in their expanded 1943 inspection program.

3213

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

changeable use for protection against common respiratory hazards faced by industrial workers. All fit the standard R-1000 respirator.

Portable Sanding Machine

A portable vibrationless electric sander, compact in size and with a handle designed to fit the hand of either men or women operators, is being manufactured by the Sterling Tool Products Co., Chicago. It is equipped with a snap switch located on the handle within reach of the operator's thumb. A ⅕-hp. universal motor cooled by a turbine fan is protected from dust by a replaceable filter screen. The gears and counterpoise mechanism are sealed in a dust-proof cartridge-type gear case. Moving parts are supported by oversize ball and needle type bronze bearings.



A compact, portable sanding unit

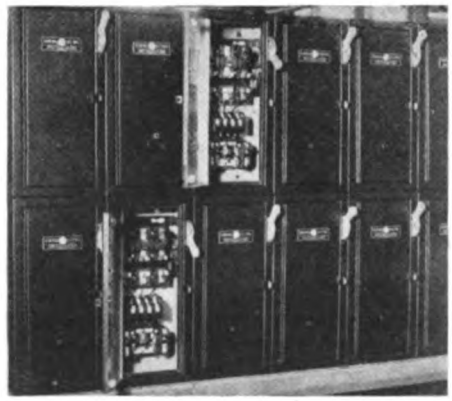
A detachable sanding pad operated by a simple latch-type lock takes one-third size sheets of standard abrasives and is sufficiently flexible to permit sanding on curved or flat surfaces. Tumbler action clamps, operated by a key or screw driver, lock the abrasive sheets on the sanding pad. The machine can be used for sanding surfaces on wood, composition or metal products. By using a felt or cloth matrix on the sanding pad the Sterling 1000 will also perform many lapping and polishing operations.

Magnetic Starters

A line of alternating-current combination magnetic starters for full-voltage starting of induction motors up to 7½ hp. has been announced by the General Electric Company, Schenectady, N. Y.

Available, as yet, only in NEMA sizes 0 and 1, the starters consist of a fusible motor-circuit switch and a magnetic starter incorporated in one compact unit to conserve space and installation time, to provide greater protection for equipment and operators, and to improve appearance. Also, to facilitate mounting groups of the starters close together, the operating handle is projected through the front rather than the side of the case.

The motor-circuit switch has silver-surfaced, snap-action contacts of the roller type which easily break stalled motor current. New Vystipe fuse clips hold the fuses securely in place by means of screw fasteners at each end, assuring good contact and preventing the fuses from being displaced if subjected to short-circuit conditions. Forms are also available with thermal circuit breakers in place of the fusible motor-circuit switch.



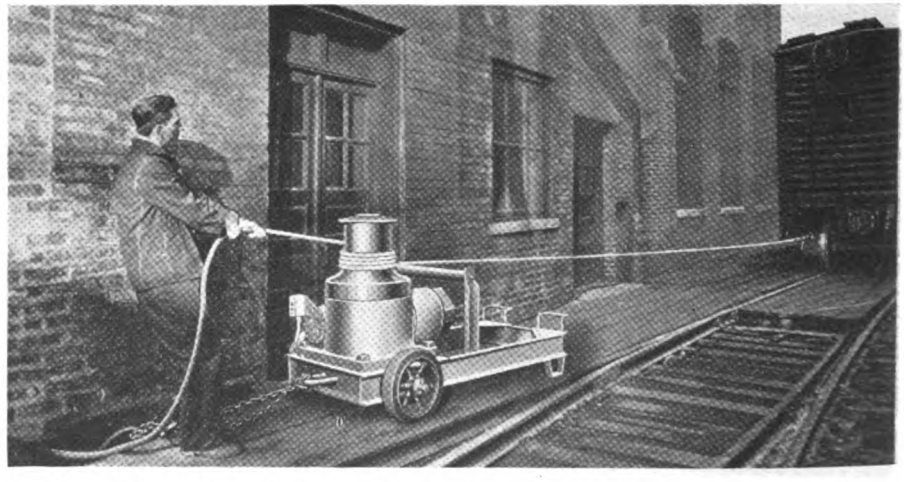
Having the operating handle in the front permits mounting the starters close together

Bimetallic overload relays are adjustable for either hand or automatic reset and protect the motor from overheating caused by repeated overloads, sustained overloads or too frequent starting.

Portable Car Spotter

The line of motorized electric car spotters made by the Link-Belt Company, Chicago, heretofore furnished only for stationary mounting, is now available also in portable form, as shown in the accompanying illustration. The spotter is so balanced on a channel iron frame that one man can lift the one end and roll the unit to any desired location.

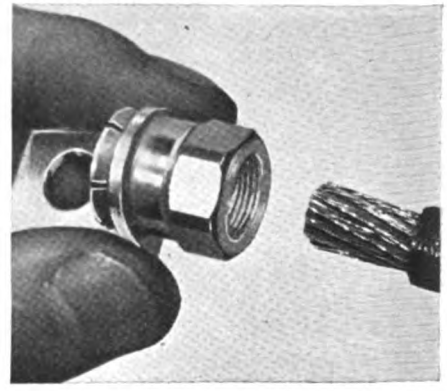
For operation, the frame is anchored with a chain, as shown, and the portable cord plugged into the nearest power outlet. One end of the haulage cable is hooked to car or object to be moved, and the other end wrapped around the capstan. By this means the standard machine has been given added versatility for spotting cars on any number of tracks. It is also useful for hauling trucks, and doing other moving jobs at separated locations.



The spotter may be used at any point where it can be anchored near an electrical outlet

Cable Lug

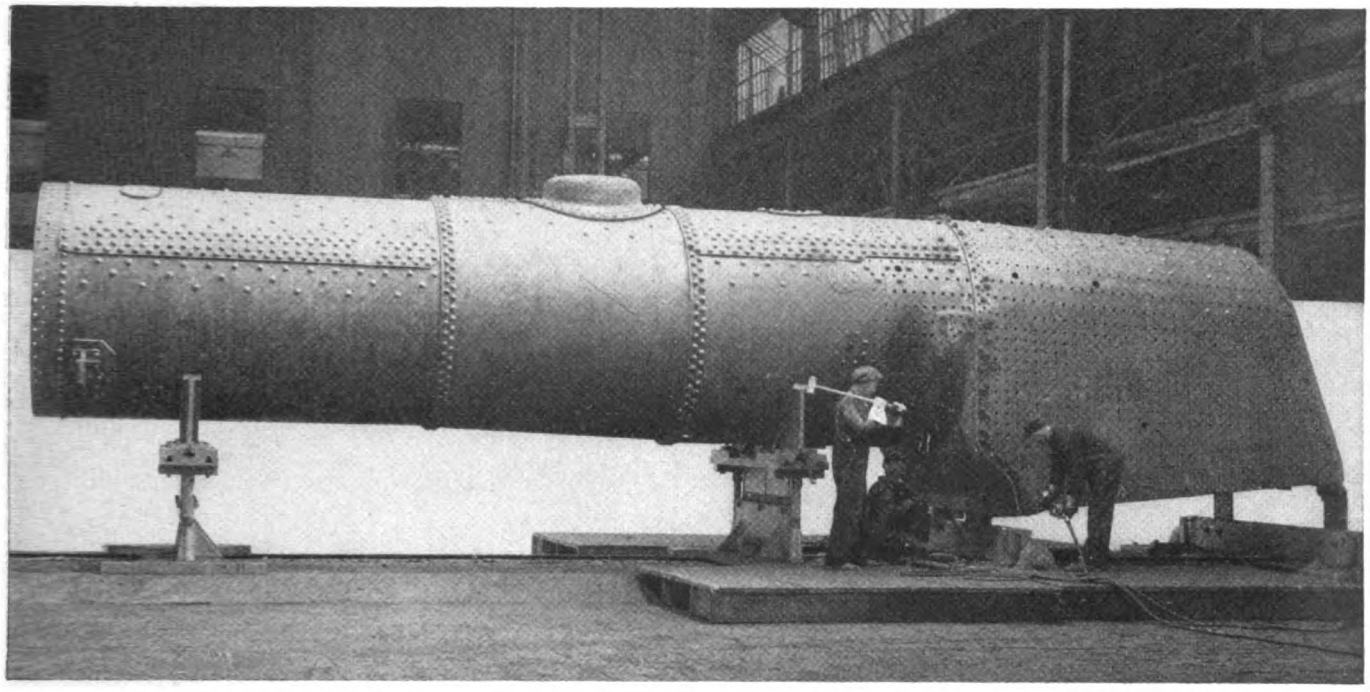
A light-weight cable lug for wire sizes 2, 0 and 00, suitable for railway, aircraft, marine and commercial installations, has been developed by Aircraft-Marine Products, Inc., Elizabeth, N. J. It features the collet type clamping ring which, when compressed by the tightening nut, applies uniform pressure from all directions insuring adequate electrical contact. The wire end is always visible, allowing easy inspection of the contact. Although mechanically strong, the contact will not injure the wire strands. When the tightening nut is released, the collet ring expands, permitting the wire to be removed.



The connector insures good conductivity and high mechanical strength

The lug is composed of only three simple parts and no special tools are required. Ordinary wrenches are used. It is made of copper for high electrical conductivity and is hot electro-tinned for corrosion resistance.

(*Turn to next left-hand page*)



Through the use of this boiler jig perfect alignment between boiler shell and back end is assured. It is through such methods as this that Lima has earned its enviable reputation as a builder of low-maintenance steam power

Lima Locomotives

ARE BUILT FOR HARD WORK

"Availability" of locomotives is all important these days.

Those locomotives are most valuable that keep out of the shop.

Lima has always been keenly aware of this factor and has developed many special methods and tools to insure greater accuracy of manufacture and the resultant higher degree of availability.

Lima power is being worked hard today but Lima power is built to "take it".

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

High Spots in
Railway Affairs . . .

Trainwomen

At this writing, the middle of February, the Pennsylvania Railroad has three women assigned to passenger trainman service on Philadelphia suburban trains. They perform the regular duties of passenger brakemen, and were required to pass rigid physical tests and be at least 21 years of age. Twenty-seven other women have made their student trips and will be assigned to Philadelphia suburban trains and Baltimore and Harrisburg locals. The uniform consists of a fitted blue coat with P. R. R. insignia on the lapels, a plain blue skirt, white shirt, black four-in-hand tie and a blue trainmen's hat. A top coat conforms closely to the regular trainmen's coat.

Mexican Rolling Stock Bottleneck Eliminated

American creditors, in an attempt to collect claims, have sought to attach Mexican railroad equipment which has entered this country. To avoid such seizure, an announcement of the Treasury Department of the United States states that "a large volume" of war materials has heretofore been transferred at the border from Mexican to United States cars. This has caused a serious bottleneck. To remedy this situation the Treasury Department has issued regulations barring all legal and other proceedings which might interfere with the free and unrestricted use and operation of Mexican railroad equipment within the United States. This will not, however, apply to service and repair charges and other claims arising on and after the date of the ruling (February 4), out of the operation within the United States of the rolling stock involved.

Traffic Prospects

Despite the fact that car loadings this year have been running below comparable weeks in 1942, Director Eastman of the Office of Defense Transportation believes that freight traffic in 1943 will exceed that of 1942 by 11 per cent on a ton-mile basis. This statement was made at a meeting of the directors of tne Association of American Railroads late in January. The Bureau of Railway Economics now anticipates that passenger-miles in 1943 will be up 20 per cent, instead of 15 per cent, as it previously estimated. Director Eastman bases his anticipation of increased freight traffic on the demand for military transportation; the belief that the 1943 lake ore movement will exceed last year's record of 92 million tons; the increase in shipbuilding; increased grain shipments following upon the release of storage space as grain moves abroad; increased coal mining, and the further diversions from highway transport as the truckers experience further difficulty with rubber and manpower shortage.

"Austerity" Locomotives Used on British Roads

The Railway Gazette of London in its issue of January 1, 1943, states that "the American-built austerity locomotives which have arrived in this country have received wide publicity." It draws attention, however, to the fact that, contrary to popular belief, these do not set a precedent for the use of American-built locomotives in that country. In 1840—more than 100 years ago—locomotives built by Norris of Philadelphia were used for hauling trains up the Lickey Incline on the former Midland Railroad; some of these were still in use as late as 1860. In 1889 and 1900 a number of 2-6-0 locomotives built in the United States were acquired by British railways. After the first World War a number of 4-6-0 tank locomotives which were built for war service on light railways in France and other fronts were purchased for use on certain light railways in Great Britain.

Wanted—Railroad Watches

There is a shortage of railroad watches. The Consumers Durable Goods Division of the War Production Board has issued an appeal stating that, "Anyone having a railroad watch which he does not use for essential purposes can contribute to the war effort by selling it for railroad use." The watch should be taken to a railroad watch inspector. The nearest local jeweler can direct you to him; or an inquiry may be sent to the Watch and Clock Unit of the Consumers Durable Goods Division, WPB, Washington, D. C.

Bureaucracy Runs Riot

How long will the American people continue to stand for the bureaucrats in Washington who feed so voraciously on public patronage? No one can gainsay the fact that the Railroad Retirement Board requires a large staff, but the nature of its work is such that its staff of experts should possess certain technical ability and good, sound commonsense. The Railway Age points out that Maurice Parmelee is now employed as an economist by the Railroad Retirement Board at a salary of $4,600. He is the author of "numerous volumes, all of them revolutionary in character," and one of them advocating "the practice of universal nudism in office and factory." According to Representative Dies, chairman of the committee investigating un-American activities, Parmelee was dismissed by the Board of Economic Warfare after Dies' exposure of his activities, which included several years spent in European nudist camps. As Congressman Dies pointed out, however, "the great bureacratic family was not to leave Parmelee jobless for long."

East Coast Oil Movement

The tank car movements of petroleum and its products to the East Coast area averaged within a few thousand of 800,000 barrels a day during the last half of January, and are now probably bettering that figure. For the week ending January 23, they averaged 798,552 barrels a day, and for the following week ending January 30 they averaged 796,458 barrels a day. Recently about 700 tank cars formerly used for other products have been devoted to this purpose. Box car shipment of kerosene to New England in drums has also been increased—it averaged 8,266 barrels a day for the week ending January 30. Completion of several links in pipe line projects are proving helpful. One hundred box cars are also being fitted with linings for the transportation of oil, fifty with Flexitank Corporation "flexitanks" and fifty with Glenn L. Martin Company "Mareng-cells."

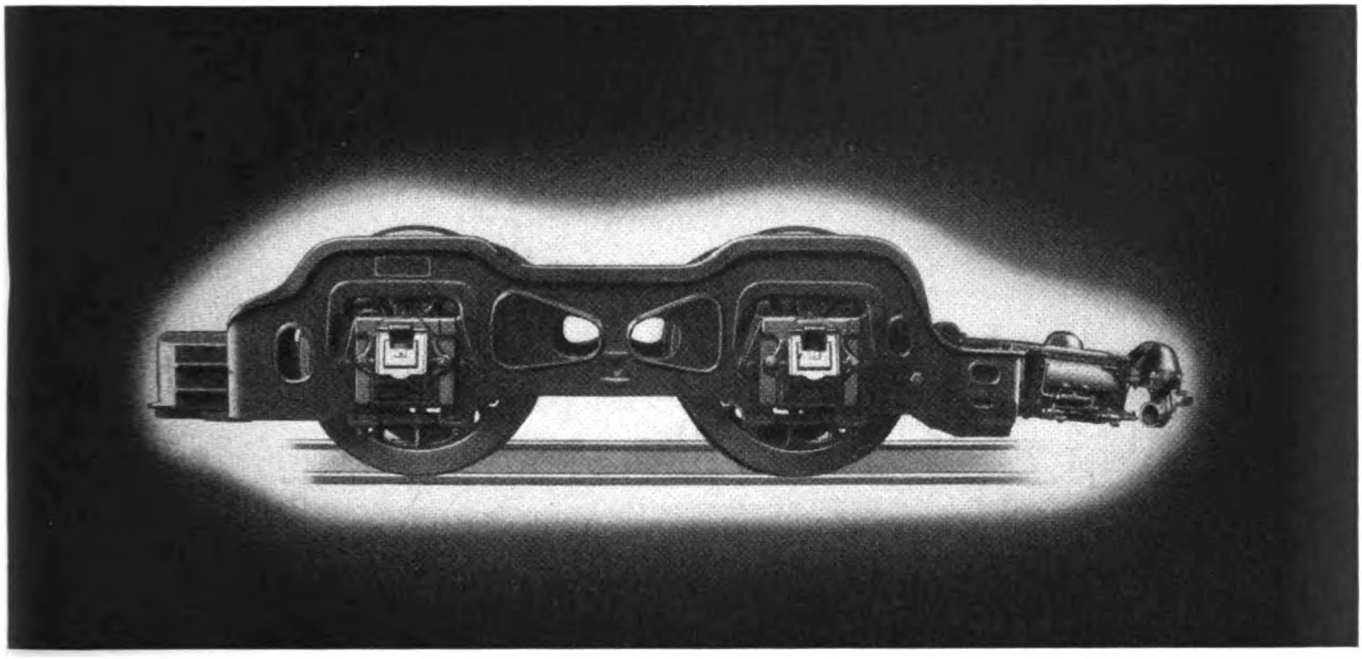
Job Too Big For One Man

Railroad labor organizations and the National Mediation Board, itself, have been concerned for several months because of the board being short-handed. Otto S. Beyer, one of the three members, was given an indefinite leave of absence about a year ago to accept full-time service as director of the Division of Transport Personnel of the Office of Defense Transportation. On February 1, David J. Lewis, a former Congressman from Maryland and now in his 74th year, retired as a member of the board. This left only the chairman, George A. Cook. The Railway Labor Executives Association complained that "for nearly two years the National Mediation Board . . . has been impaired by inadequate members and now there is only one member of the board." On February 11 President Roosevelt sent to the Senate the names of Dr. William M. Leiserson to succeed Mr. Lewis and Ex-Senator H. H. Schwartz of Wyoming to fill out the unexpired term of Captain Beyer.

(Turn to next left-hand page)

MORE TONS PER LOCOMOTIVE

WITH THE BOOSTER'S HELP



With locomotives loaded to capacity the Locomotive Booster is making it possible to move thousands of tons more freight every working day.

Booster-equipped locomotives have the extra power to get full tonnages moving and to accelerate to road speed from slow-downs.

By helping in any tight place, they are contributing importantly to the fine record of tons hauled per locomotive mile.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

NEWS

Kelly Replaces Kelly in ODT

H. H. KELLY has been appointed director of the Division of Material and Equipment Requirements of the Office of Defense Transportation, replacing Warren W. Kelly, who asked to be relieved of the responsibility of directing the division on account of his health. The latter Mr. Kelly will continue his association with the division in a consulting capacity.

ODT Promotes Mechanical Men

SHANNON KUHN, mechanical assistant of the Division of Railway Transport, Office of Defense Transportation, has been promoted to deputy director, and has been succeeded as mechanical assistant by J. D. Loftis, Jr., who has been locomotive assistant.

Mr. Kuhn, who came to ODT last June, was formerly master mechanic of the New York Central at its Cleveland, Ohio, shops. Mr. Loftis, who has been with ODT since last August, was formerly associated with the Denver & Rio Grande Western.

Tank-Car Brakes Need More Attention

A CIRCULAR letter, sent out by the A.A.R. Mechanical Division, under date of January 21, calls attention to a number of brake conditions which should receive more careful attention before tank cars are loaded and also after they have been made empty and before the return movement for another load.

Many cars are being cut out of trains and placed on repair tracks, particularly in loaded movement, on account of air brakes being cut out. When making air tests on such cars it has been found that approximately six out of every ten cars set out for this reason meet test requirements and should not have had their air brakes cut out. This condition can be overcome if more care is exercised in making air tests at terminal points when air-brake tests are made. Air brakes must be "in date" and in operative condition before being placed for loading or before being returned empty from point where unloaded.

Many cars, particularly tank cars, are said to be arriving at various terminals with increased cylinder piston travel, in many cases as much as 10 in. Cylinder piston travel must be adjusted to not less than 7 in. nor more than 9 in., preferably 8 in., before cars are placed for loading or before being returned empty from point where unloaded, as per A.A.R. Standard.

Many cars are being shopped en route because of loose air-brake cylinders, reservoirs and piping. Some cases are found where the entire train brake air line is loose, broken or leaking on account of not being properly clamped in place.

It is urged that all concerned take necessary action to condition air-brake equipment properly on tank cars before loading and before they are returned empty, in order to eliminate delays caused by cars being set out en route for repairs.

Vice-chairman V. R. Hawthorne points out that a review of the replies received to date on Form TCCO indicates that the major defects causing cars to be cut out of trains en route are brake-rigging defects, wheel defects, coupler and coupler part defects, broken train line and crossover pipes. This indicates that if greater care and attention were paid to maintaining concentric wheels under equipment, further effort made to prevent too much free slack in draft gears, and closer inspection of brake beams and brake rigging, a large number of defects on cars en route would be eliminated, all of which would improve the serviceable car days of equipment and further assist in the war effort in the present emergency movement of petroleum products to the eastern seaboard.

This same condition with respect to defects causing frequent shoppings of cars also applies to all classes of equipment, and if every effort were made to insure these defects being corrected before cars are placed for loading and at the time cars are made empty before being again offered for loading, a great number of these defects which occur en route would be eliminated and the serviceable car days of all types of equipment increased.

Equipment Installed on Class I Railroads in 1942

CLASS I railroads put 63,009 new freight cars and 712 new locomotives in service in 1942, according to the Association of American Railroads. This was the smallest number of new cars to be installed since 1939 but the greatest number of locomotives since 1930. It compares with the 80,502 new freight cars and 633 new locomotives put in service in 1941.

Of the new freight cars installed last year, there were 34,713 box, 23,144 coal, 2,938 flat, 631 refrigerator, 100 stock and 1,483 miscellaneous cars. The new locomotives installed included 308 steam and 404 electric and Diesel-electric compared with 161 steam and 472 electric and Diesel-electric in 1941.

Class I railroads on January 1 had 27,061 new freight cars on order, compared with 74,897 cars on the same date one year ago. The former figure included 7,301 box, 17,946 coal, 1,444 flat, 200 stock and 170 miscellaneous cars. New locomotives on order on January 1 totaled 888, which included 355 steam and 533 electric and Diesel-electric. On January 1, 1942, there were 546 on order—258 steam and 288 electric and Diesel-electric.

WPB Plans Release of Most of 20,000 Cars for First Half of 1943

THE War Production Board is reported to have granted authorizations for the building of 19,810 of the 20,000 cars planned for delivery during the first six months of 1943. Of this number, 4,585 were allocated to five railroad shops and 15,225 to seven contract car-builders. Although the 19,810 cars released included a number ordered in January, 1943, most of the cars to be built were on order but "frozen" at the year-end. The majority of the cars will be of composite wood and steel.

General Young Appointed Deputy Director, ODT

BRIGADIER GENERAL CHARLES D. YOUNG has been appointed deputy director of the Office of Defense Transportation under a directive issued on January 16 by Director Eastman. The directive stipulated that, in the absence of the director from Washington, General Young "may act for him on matters requiring immediate attention."

Also, he will "advise and assist the Director and subject to him will have direction and control in all matters pertaining to the responsibilities of this office as a claimant agency in the War Production Board;" and "assist the Director and perform such other duties as may be assigned to him."

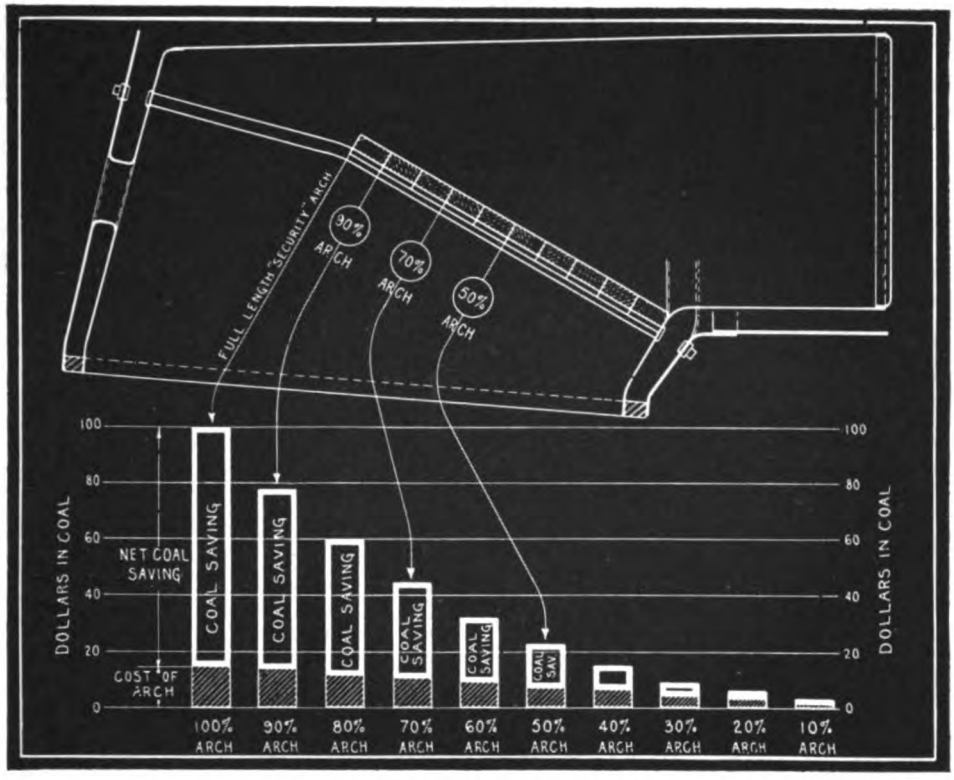
General Young, a former vice-president of the Pennsylvania, has been assistant director of ODT since his retirement from active army service last June. Prior to that tour of duty he was director of ODT's section of materials and equipment, predecessor to the present division of material and equipment requirements.

Rail Manpower Committee Considers Replacement Schedule

THE Rail Manpower Committee, appointed at the request of the Office of Defense Transportation to represent Class I roads, "has given favorable consideration to the Replacement Schedule which has been prepared by the Selective Service System to provide an orderly control of the withdrawal of Selective Service eligibles from industry," according to an announcement from ODT on January 28.

Meanwhile at the general meeting the representatives of the Manpower Commission sought cooperation of the railroads in developing a railroad training program. In that connection it was recognized that some of WMP's training facilities are already being utilized by railroads, the foreman training program having been "particularly well received." Other discussions at the meeting included a talk by Dorothy M. Sells, chief of the Personnel

(*Continued on next left-hand page*)



THE EFFECT OF ABBREVIATED ARCHES ON FUEL SAVING

FUEL CONSERVATION... a wartime need!

Fuel wastage is a two-fold loss; the fuel itself and the transportation necessary to haul it. Because of the strategic importance of fuel to the war program every effort must be made to conserve this vital material.

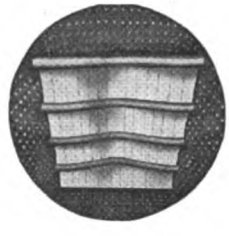
The fuel economy of Security Sectional Arches has been thoroughly proved in over 32 years of service on American railroads. But only a *complete* Arch can produce maximum fuel savings.

You need a full Arch for full fuel economy.

THERE'S MORE TO SECURITY ARCHES THAN JUST BRICK

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists



AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.
Locomotive Combustion Specialists

Supply Section of ODT's Division of Transport Personnel, who recently returned from England, where she studied utilization of British women to meet manpower shortages in transportation.

The Rail Manpower Committee is headed by Dr. Julius H. Parmelee, director of the Bureau of Railway Economics; while ODT representatives at the meeting were headed by Otto S. Beyer, director of the Division of Transport Personnel.

Equipment Purchasing and Modernization Progress

New York Central.—A contract has been awarded to the Walsh Construction Company, for the replacement of twelve 97-ft. engine stalls with 16 stalls at Bellefontaine. Of the new stalls 13 will be 130 ft., 2 will be 110 ft., and one 95 ft. in length.

Pennsylvania.—The Pennsylvania company has applied to the Interstate Commerce Commission for authority to assume liability for $6,450,000 of equipment trust certificates, series N, to be applied to the purchase of part of certain equipment of a total cost of about $15,300,000, which will be supplemented at a later date by an application for authority to assume additional liability if more of the equipment becomes available. It is proposed to purchase under this arrangement five electric passenger locomotives, 51 steam locomotives, 30 locomotive tenders, six Diesel-electric switching locomotives, and 1,000 heavy-duty gondolas, but authority is sought to substitute other equipment of equivalent value under the trust if portions of the specified equipment are not available. With the exception of the Diesel-electric switching locomotives, the equipment is to be constructed in the company's shops.

The Pennsylvania has invited bids for the purchase of $6,450,000 of the equipment trust certificates, which are part of a proposed aggregate issue of $12,240,000 of certificates under the railroad's equipment trust series N.

The 1,000 heavy-duty gondola cars will be of 70 tons' capacity with wood planking used temporarily in the side sections to conserve steel. War Production Board approval has been obtained for construction of the cars, which have been designed so that after the war the plank side sections can be replaced readily with steel plates to assure the long-term durability of all-steel construction. The underframe and trucks are of steel, and steel posts and braces are provided for the temporary plank side sections. (The railroad already has in operation 1,500 open-top freight cars of composite wood and steel design which also incorporate provision for replacing the plank sections with steel after the war. Of these, 500 are 70-ton gondolas, 500 are 50-ton gondolas and 500 are 50-ton hopper cars.) The construction program calls for all of the new cars to be in service during the first half of 1943. Total cost is estimated at $3,150,000.

St. Louis-San Francisco.—This road has filed a petition in the District Court seeking permission to spend $3,103,485 in 1943 for rails, equipment and improvements. The program includes, among other projects, the improvement of freight cars; the modernization of passenger equipment; and the purchase of new parts for 165 locomotives. Of the total, $2,711,418 will be for the Frisco and the remainder will be spent on subsidiaries.

Southern Pacific.—Division 4 of the Interstate Commerce Commission has authorized the Southern Pacific to assume liability for $3,950,000 of equipment trust certificates, series U, to be issued to finance in part the purchase of 22 locomotives. The certificates will mature serially in 10 equal annual installments, the five first due to bear interest at two per cent and the others at 2½ per cent.

Eastman Sees 11 Per Cent Increase in Ton-Miles

DESPITE the fact that carloadings in recent weeks have been below those of comparable 1942 weeks, Director Eastman of the Office of Defense Transportation still thinks that 1943 freight traffic, as measured by ton-miles, will be 11 per cent in excess of the 1942 volume. Mr. Eastman expressed this view to directors of the Association of American Railroads at their meeting in Washington, D. C., on January 29.

He said that ODT had recently reexamined the 11 per cent estimate on which it agreed with the A. A. R. some time ago, and saw no reason to change it. Likewise, the current Bureau of Railway Economics estimate places the 1943 ton-miles from 10 to 11 per cent above 1942, while it now anticipates that passenger-miles will be up 20 per cent instead of the 15 per cent previously estimated.

Among the reasons which Mr. Eastman gave for adherence to the traffic-rise estimate were the increased demand for military transportation; the expectation that next season's lake-ore movement will be above 1942's record of 92,000,000 tons; the increase in shipbuilding; increased grain shipments following upon the release of storage space as grain moves abroad; the possibility of increased coal mining; and the prospects for further diversions from highway transport as truckers experience continuing difficulties as a result of the rubber shortage and their manpower problem which was said to be more acute than that of the railroads.

North Western Streamliner Diesels Do 517 Miles a Day

THE five Diesel-electric locomotives used by the Chicago & North Western on its fleet of "400" streamliners have averaged 517 miles per day each during the first year of operation. The five locomotives were ordered early in 1941 for use on seven streamline trains operating between Chicago and Milwaukee, Wis., Green Bay, Madison, Oshkosh, Manitowoc, Escanaba, Mich., Negaunee, and Ishpeming and the last was delivered in August of that year. Up to January 12, 1943, they had traveled 943,332 miles, excluding the mileage accumulated during several months of test runs prior to going into regular service.

1942 Locomotive Shipments

LAST year's shipments of railroad locomotives totaled 1,602, as compared with 970 in 1941 and 587 in 1940, according to reports made by builders other than railroad shops to the Department of Commerce's Bureau of the Census. The 1942 total included 715 steam locomotives, 22 electrics, 787 Diesel-electrics, and 78 of other types, as compared with 1941 shipments of 182 steam locomotives, 18 electrics, 712 Diesel-electrics, and 58 of other types.

On December 31 the builders had unfilled orders for 1,967 locomotives, including 1,139 steam, 43 electrics, 781 Diesel-electrics, and four of other types. At the close of 1941 the unfilled orders totaled 1,210 locomotives, including 526 steam, 49 electrics, 584 Diesel-electrics, and 51 of other types.

Data supplied by the Car Service Division, Association of American Railroads,

(*Continued on next left-hand page*)

Orders and Inquiries for New Equipment Placed Since the Closing of the February Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Broder Co. Port Authority, Ft. Lauderdale, Fla.	1[1]	600-hp. Diesel-elec.	Electro-Motive Corp.
Central of Georgia	8[2]	4-8-4 (pass.-frt.)	Lima Loco. Wks.
Lehigh Valley	10[1]	4-8-4	American Loco. Co.
Nashville, Chattanooga & Tennessee	10[1]	4-8-4	American Loco. Co.

LOCOMOTIVE INQUIRIES

Chesapeake & Ohio	25	2-8-4

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Atchison, Topeka & Santa Fe	200[3]	70-ton gondola	Pullman-Std Car Mfg. Co.
Chesapeake & Ohio	500[3]	50-ton hopper	Pullman-Std Car Mfg. Co.
	500[3]	50-ton hopper	American Car & Fdry. Co.
	500[3]	50-ton hopper	Gen.-Amer. Trans. Corp.
New York Central	1,000[3]	Gondola	Despatch Shops, Inc.
	300[3]	Flat	Despatch Shops, Inc.
Northern Pacific	300[1]	50-ton flat	American Car & Fdry. Co.

FREIGHT-CAR INQUIRIES

Chicago & North Western	250	70-ton ore

[1] Authorized by WPB.
[2] Authorized by WPB. Order originally placed with the Baldwin Locomotive Works. Deliveries expected to begin in June.
[3] Order and approval of WPB unconfirmed.

STEAM MARCHES *ON!*

The abnormally heavy rail traffic is being successfully handled principally by steam locomotives.

These locomotives are equipped with ELESCO devices that substantially increase locomotive capacity, so essential with traffic increasing.

ELESCO



Illustration, courtesy of Association of American Railroads.

A-1565

SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

THE SUPERHEATER COMPANY

Representative of
AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
122 S. Michigan Blvd., CHICAGO

• • •

Montreal, Canada
THE SUPERHEATER COMPANY, LTD.

on locomotive building in railroad shops show that 82 locomotives, including 64 steam and 18 electrics, were thus produced in 1942, as compared with a 1941 total of 24 locomotives, including 20 steam and four electrics. On January 1 railroad shops had unfilled orders for 105 locomotives, including 92 steam and 13 electrics.

Over 100,000 Women Relieve Manpower Shortage on British Railways

More than 100,000 women now are employed on the railways of Great Britain, including the London Transport Board operations, out of a total of some 600,000 employees, according to a statement by Dorothy Sells, of the Division of Transport Personnel of the Office of Defense Transportation, issued in Washington after her return from a three-months' investigation of the employment of women in England to meet manpower shortages in the transportation industry.

While the greater number of women employees are engaged in unskilled and semi-skilled jobs, "a good many" are doing highly skilled work, she said. As a result of the acute manpower shortage, which has led to the development of mechanical lifting devices and to "de-skilling" mechanical operations, women are employed to some extent on heavy work normally requiring great physical strength, or in tasks involving a relatively high degree of mechanical skill, and others are found in such jobs as blowing out boiler tubes, laying rails, steam-cleaning wheels from pits, lifting ashes, and lubricating locomotives.

Miss Sells reported that practically no evidence of opposition to the employment of women was expressed by railroad men in Great Britain. The National Service Act provides that men in the services can return to their former jobs when the war ends, and union agreements provide that women shall get the same pay as men if they do the same work, she pointed out, so that two important possible causes for friction are eliminated. In general, Miss Sells added, the women look upon their work in the transportation industries as part of the war effort, not as a field for future employment.

Many women have been working as much as 60 hours per week, the ODT investigator reported, but the tendency is to shorten the working week somewhat below this level. On the other hand, in many instances it has been more satisfactory, she said, to employ women on a part-time basis, so that their strength would not be taxed in difficult jobs, and also to permit them to take care of their homes and community obligations without making a bad record for absenteeism.

On the British railroads Miss Sells found very few women in train-service work, and these were "guards" on little-used branch lines. On the other hand, they are employed widely in stations and to some extent in shops, she reported. There are a great many women train announcers, check room attendants, baggage porters, and "platform porters" (freight handlers). A few women are stationed in branch line "signal boxes," and a good many work in the shops under male supervision.

While women do as much work as men in certain jobs, Miss Sells said, in many others they do not. For example, three women platform porters do the work of two men. In the shops it is still necessary to have men "set-up" the work on many of the machines operated by women. While close supervision of women is frequently required, it very often is possible to employ super-annuated men employees for this purpose, so that able-bodied men are not diverted from productive work.

Perhaps 80 per cent of British women transportation workers are trained on the job, she said, but the railroads provide schools to train certain classes of employees, such as ticket sellers and platform porters. Some training courses in mechanical work are provided by the railroads, she added, but government training centers, originally set up to train the unemployed before the war began, give most of the formal instruction in this field. In these eight-week courses women are taught fundamental mechanical principles, blueprint reading, safety methods, and other rudimentary topics.

As a result of her observations in England, Miss Sells indicated that the ODT program for employing more women in American transportation industries would be revised in spots and then widely promoted.

Rail and Labor Executives to Promote Manpower Program

Working under the auspices of the Office of Defense Transportation for the "alleviation of manpower problems in the railroad industry," spokesmen for the regional railroad executives' associations and railway labor organizations on January 29 unanimously agreed upon a 13-point program in the form of a "statement of principles," which leaves to individual managements and system labor organization representatives the job of carrying out "each step by agreement."

The 13-point program, as set forth in the ODT announcement, follows:

1. Relaxation of yard operating rules to permit crews delivering cars to the yards or tracks of another road to haul back cars to their own road, so as to give the engine a load in both directions.
2. Continued employment, as long as physically able, of men eligible for retirement under the Railroad Retirement Act.
3. Cooperation of management and workers to reduce absenteeism to a minimum.
4. Relaxation of road mileage limitations and of hourly limitations in yard service.
5. Efforts by labor and management to work present forces full straight time and to distribute uniformly such overtime as may be required.
6. Upgrading and promotion within or without any group, seniority being retained in the original group, so as to bring about fullest possible utilization of training and skills of present employees and minimize problems of obtaining and inducting new employees.
7. Transfer of shop work from one railroad to another to meet critical labor shortages. Transfer of employees from one railroad to another, with preservation of seniority rights on original job.
8. More intensive on- and off-job training, and provision for some pre-employment training. Consideration of payment of compensation during pre-employment training periods.
9. Cooperative effort to encourage return of retired employees.
10. Relaxation, so far as practicable, of age and physical examination requirements.
11. Induction of new employees, so far as practicable, into lower skilled brackets so as to minimize the need for pre-employment training and to expedite on-the-job training.
12. Consideration of employment of women of railroad employees' families.
13. Relaxation of the present 16- to 21-year age limits for employment of shop craft apprentices, so as to permit training of men who will be able to remain in service.

Claimant Agencies Receive First Allotments Under CMP

Fourteen claimant agencies, including the Office of Defense Transportation, have received from the War Production Board's Requirements Committee their first allotments of steel, copper, and aluminum under the Controlled Materials Plan. The allotments are for the second quarter of this year, but the WPB announcement pointed out that claimant agencies "are authorized to make plans for continuation of current programs into subsequent quarters on the basis of declining percentages of second quarter allotments."

Details of the distribution among the claimant agencies were not made public "for reasons of military security"; although it was revealed that the overall requests exceeded the 15-million-ton carbon-steel supply by 17 per cent, the two-million-ton alloy-steel supply by 15 per cent, the 600,000-ton copper supply by 16 per cent, and the 600-million-lb. aluminum supply by 14 per cent.

Thus presumably the ODT program was cut substantially; for WPB Chairman Donald M. Nelson said that "full provision" had been made for the current "must" programs, which he listed as "synthetic rubber, high-octane gasoline, aviation, army materiel, merchant and naval shipping and escort vessels." He added that "less essential programs have been cut to the bone."

Meanwhile, Ferdinand Eberstadt, program vice-chairman of WPB and chairman of the Requirements Committee, said that the allotments were "kept within our material budget"; and thus Mr. Eberstadt thinks that CMP has been launched with a view to achieving its main purpose "to assure delivery of material needed to produce approved programs, to deliver it on time in the exact amount."

WPB Defines "Scrap"

The War Production Board's distinction between the terms "dismantle" and "scrap," as used in its Limitation Order L-97 as amended—the provisions of which were outlined in February issue, page 107—is clarified by Interpretation No. 1 to that order, issued February 15. "Dismantle," as the term is used in this order, means to remove or strip all usable parts from a locomotive for re-use on other locomotives and then to scrap the remaining material. "Scrap" is used to indicate conversion of the entire locomotive to scrap without removing any parts for re-use. These definitions are the basis of distinctions in authorizations under the order applied for on Form PD-747.

Supply Trade Notes

BEAVER PIPE TOOLS, INC.—*W. A. Neracher*, founder and president of Beaver Pipe Tools, Inc., Warren, Ohio, has been elected to fill the newly created position of chairman of the board. *W. A. Phillis*, formerly vice-president, becomes president and general manager; *M. W. Bechtel*, executive vice-president and treasurer; *C. W. Shafer*, vice-president manufacturing; *E. R. Barkley*, vice-president, sales, and *R. C. Mellinger*, vice-president, accounting.

◆

JOSHUA HENDY IRON WORKS.—The Joshua Hendy Iron Works of Sunnyvale, Calif., has acquired the *Crocker-Wheeler Electric Manufacturing Company* of Ampere, N. J., and the *Pomona Pump Company* and its subsidiary, the *Westco Pump* division, of Pomona, Calif., and St. Louis, Mo.

◆

LOCOMOTIVE FIREBOX COMPANY.—*M. A. Foss*, assistant vice-president of the Locomotive Firebox Company, has been elected vice-president, with headquarters as before at New York.

◆

STANDARD CAR TRUCK COMPANY.—*J. C. Bloomfield*, sales representative of the Standard Car Truck Company, Chicago, has been promoted to assistant to vice-president.

◆

A. M. BYERS COMPANY.—*M. C. Morgan*, formerly field service engineer, has been appointed assistant Pittsburgh, Pa., division sales manager of the A. M. Byers Company.

◆

AMERICAN STEEL FOUNDRIES. — *The Charles F. Elmes Engineering Works* became a part of American Steel Foundries on December 31, 1942. *Charles F. Elmes* has remained as general manager and the present Elmes organization will continue intact and operate as a separate unit.

◆

CARBOLOY COMPANY, INC.—*A. F. Dobbrodte* has been appointed southern district manager of the Carboloy Company, Inc. Mr. Dobbrodte, whose headquarters are at 1719 Comer building, Birmingham, Ala., has been with the Carboloy Company since 1929. His activities have covered the design, sales and servicing of Carboloy cemented carbide tools in the Chicago, Milwaukee, Rochester, and Cleveland areas. His territory now includes Tennessee, Florida, Mississippi, Alabama, Texas, Georgia, and Louisiana.

◆

SOCONY-VACUUM OIL COMPANY.—*Don B. Alexander, R. O. Nash*, and *E. D. Kruger* have been appointed special representatives, Railroad Division, of the Socony-Vacuum Oil Company, with headquarters in Cleveland, Ohio; St. Louis, Mo., and Kansas City, Mo., respectively. *J. G. Christopher*, for the past several years industrial sales manager of the New York City division, has been appointed eastern manager of railroad sales, with headquarters at New York.

Mr. Christopher began service in 1910 in the foreign accounting department of the Standard Oil Company of New York, and later became a member of the sales organization of the Vacuum oil company, which merged with the Standard Oil Company of New York. He served in the sales organization in Chicago, Indianapolis, Ind., in upper New York state, and in the New York city area. Mr. Christopher subsequently became lubricating oil manager, New York City division of Socony-Vacuum, and later industrial sales manager.

◆

AMERICAN STEEL & WIRE CO.—*Charles H. Eisenhardt* has been appointed assistant manager of the electrical, wire rope and construction materials sales division of the American Steel & Wire Co., a United States Steel subsidiary, succeeding *R. L. Rhodes*, resigned. Mr. Eisenhardt has been associated with the wire company since May, 1925, when he was employed as a stenographer in the Baltimore, Md., sales office. He was successively a price clerk, correspondent and salesman in the Baltimore office before being assigned to the position of special sales representative in Washington, D. C., in August, 1942.

◆

ALLEGHENY LUDLUM STEEL CORPORATION.—*Arnold W. Nelson* has been appointed district representative in the Minneapolis, Minn., territory for the Allegheny Ludlum Steel Corporation, to succeed the E. L. Sandberg Company. *F. B. Lounsberry*, vice-president in charge of manufacturing, has transferred his headquarters from Watervliet, N. Y., to the Allegheny Ludlum general offices at Brackenridge, Pa. *Dr. G. M. Butler*, research engineer in the Dunkirk, N. Y., laboratories of the corporation, has been appointed chief metallurgist in charge of technical control and research. *Robert H. Gibb*, assistant district manager of the corporation at Pittsburgh, Pa., has been appointed district manager at Pittsburgh, Pa., office.

◆

COPPERWELD STEEL COMPANY. — The Copperweld Steel Company has consolidated its former southwestern and southeastern districts into a new southern district under the supervision of *E. B. Patterson*, southern sales manager, with offices at Memphis, Tenn. The new district comprises the states of New Mexico, Texas, Oklahoma, Louisiana, Arkansas, Tennessee, Mississippi, Alabama, Georgia, North Carolina, South Carolina and Florida. Southern district branch offices will be maintained at Dallas, Tex., and Atlanta, Ga.

◆

GENERAL ELECTRIC COMPANY.—*A. W. Baker* has been appointed transportation specialist of the Atlanta, Ga., transportation department of the General Electric Company, to succeed the late F. A. Kroner.

◆

E. W. HUSEMANN has been appointed metallurgist in the Metallurgical Department of the Copperweld Steel Company at Warren, Ohio. Mr. Husemann was formerly with the Republic Steel Company at Chicago.

◆

AMERICAN BRAKE SHOE & FOUNDRY COMPANY, AMERICAN MANGANESE STEEL DIVISION.—*James R. Hewitt*, formerly assistant to the vice-president, has been appointed vice-president of the American Manganese Steel division of the American Brake Shoe & Foundry Co.

◆

BY-PRODUCTS STEEL CORPORATION. — *Raymond M. Dennis* has been appointed assistant to the president of the By-Products Steel Corporation, a subsidiary of the Lukens Steel Company, Coatesville, Pa. Mr. Dennis had been general manager of the flanging department of Lukens. *John S. Morris* has been appointed methods engineer.

◆

CATERPILLAR TRACTOR COMPANY.—*James H. Deaderick*, assistant general parts manager of the Caterpillar Tractor Company since February, 1941, has been named a vice-president of the company with administrative direction of the parts, service and traffic departments. Mr. Deaderick studied at the University of California until 1925, leaving to engage in the contracting business. He joined the San Leandro, Calif., offices of the Caterpillar Tractor Company as a service department employee in 1929, was transferred to Peoria, Ill., in 1930, and subsequently appointed assistant service manager in 1933. He returned to California as western service manager in 1934 and became assistant sales manager of the western division in 1939. He returned to Peoria as assistant general parts manager in 1941.

Army-Navy Production Awards

Recognition of high achievement in the production of war equipment has been made by the presentation of the Army-Navy "E" to the following companies:

American Steel & Wire Co. (U. S. Steel subsidiary), Worcester, Mass. (Renewal of Navy "E" award bestowed on June 17, 1942.)

Crane Company, Chicago. January 29.

DeVillbiss Company, Toledo, Ohio. January 11.

Fairbanks, Morse & Co. Freeport, Ill., January 13; Beloit, Wis., January 18; Three Rivers, Mich., January 21.

General Motors Corporation, Electro-Motive Division, LaGrange, Ill.

General Motors Corporation, Hyatt Bearings Division, Harrison, N. J.

Pullman-Standard Car Manufacturing Company, Hammond, Ind. January 15.

(Turn to second left-hand page)

Distinguished Service

ON THE GREAT NORTHERN



4050 Hp. GM Diesel Freight Locomotive operating between Walton and Summit.

GREAT NORTHERN

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MO

GENERAL MOTORS CORPORATION

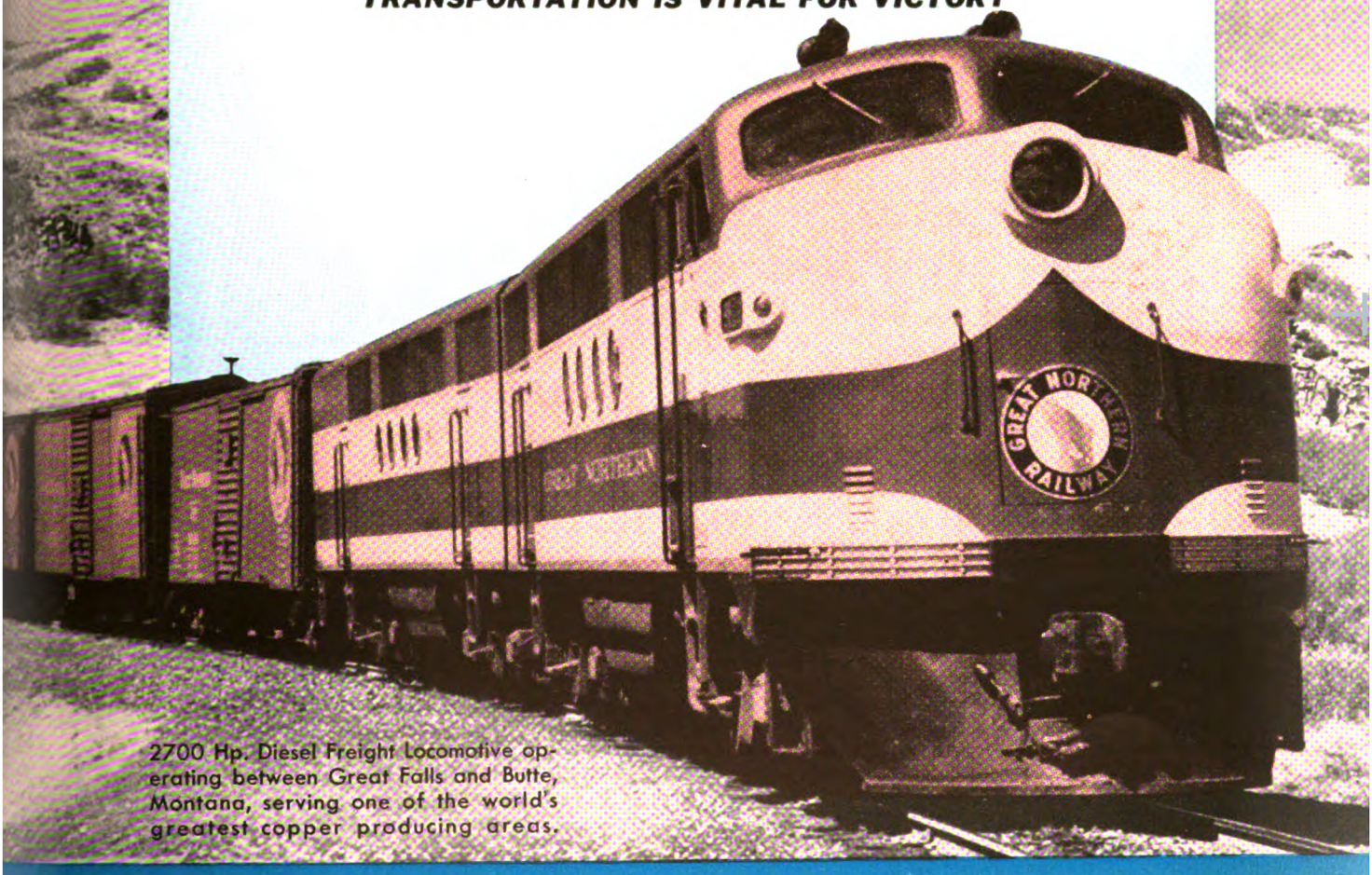
GM DIESEL FREIGHT LOCOMOTIVES
Solve Vital War Problems

GREAT NORTHERN 2700 Hp. Diesel Freight Locomotive No. 5600, operating between Great Falls and Butte, Montana (170 miles), and serving one of the world's greatest copper producing areas, has met every test — solved every problem — with typical super-performance, as evidenced by the following comparisons with steam locomotives previously used.

- **Diesel has increased maximum tonnage more than 47 percent on 2.2 percent grade — running time reduced four hours in each direction.**
- **In 62 days of operation Diesel saved 20 round trips — 6800 train miles; also saved 36 helper trips — 2103 helper miles. Helper service was entirely eliminated on a 54-mile district and reduced 50 percent on a 10-mile district.**
- **GM Diesel efficiency is not affected by altitude or extreme temperatures.**
- **GM Diesel has eliminated smoke and gas hazards in tunnels and fire hazard along right of way.**

WHY DID THE GREAT NORTHERN ADOPT GM DIESELS? The abnormal demand for copper, one of the most vital war materials, required either rebuilding the line to accommodate heavier steam power or adopting GM Diesels which had already demonstrated their ability to outperform steam without expensive changes in operating facilities. GM DIESEL LOCOMOTIVES positively reduce wear and tear on track and bridge structures. To even approach this Diesel performance with steam power would have required an expenditure of $350,000 to $500,000 for reducing grades, reinforcing bridges, enlarging tunnels and installing new turntable — an amount considerably more than the cost of the Diesel.

TRANSPORTATION IS VITAL FOR VICTORY



2700 Hp. Diesel Freight Locomotive operating between Great Falls and Butte, Montana, serving one of the world's greatest copper producing areas.

VE DIVISION
LA GRANGE, ILLINOIS, U. S. A.

JOHNS-MANVILLE SALES CORPORATION.—*Carl S. Clingman*, general sales manager of the Transportation department of the Johns-Manville Sales Corporation, has been elected a vice-president of the company. *Albert C. Pickett*, formerly assistant sales manager of the western division of the transportation department, has been appointed sales manager, western division, with headquarters at Chicago; *John D. Johnson*, formerly central division sales manager, has been appointed acting sales manager, eastern division, with headquarters at New York, to succeed *P. E. Redding*, who has been called to active duty as a lieutenant in the U. S. Naval Reserve, and *Fred Fix* has been appointed acting sales manager of the central division, with headquarters at Cleveland, Ohio, to replace Mr. Johnson.



Carl S. Clingman

Mr. Clingman was educated at Northwestern University. He began his business career in 1904 as an apprentice with the Pullman Company, and was promoted to the position of assistant general shop foreman at the Pullman, Ill., works in 1907. He was transferred to Wilmington, Del., as eastern mechanical inspector in 1908 and was appointed general mechanical inspector at Chicago in 1909. He entered the service of Johns-Manville in 1917, as sales representative in the southwest; was appointed sales manager of the western region in 1933, and general sales manager of the transportation department, with headquarters in Chicago, in 1935. As vice-president, Mr. Clingman will continue also as general sales manager of the transportation department.

Mr. Pickett joined the engineering department of the Missouri-Kansas-Texas in 1916, remaining there until 1917, when he was transferred to the stores department and appointed storekeeper at Trinity, Tex. After serving in the Army during World War I, he returned to the M-K-T in 1920 to serve on the staff of the chief engineer. He joined the Johns-Manville Sales Corporation as sales representative in 1922, and was appointed division sales manager of the southwestern division, with headquarters at St. Louis, Mo., in 1933. He resigned from Johns-Manville in 1939, returning in 1941, as assistant division sales manager of the western division.

Mr. Johnson received his early mechanical and engineering training in railroad service, working from 1907 to 1919 in the mechanical departments of the New York Central, the Missouri Pacific, and the Baltimore & Ohio. He entered the service of Johns-Manville as a salesman in the transportation department in 1920 and was appointed division sales manager of the central division in 1930.

After completing his schooling, Mr. Fix entered the service of the New York Central at Cleveland. In 1924 he entered the transportation department of Johns-Manville at Cleveland.

◆

BENNETT S. CHAPPLE, formerly assistant to the vice-president, operations, in charge of emergency defense coordination, has been appointed assistant manager of sales of the New York district sales office of the Carnegie-Illinois Steel Corporation. Mr. Chapple, before the emergency, was the company's manager of sales promotion.

◆

JOHN E. WRIGHT, formerly with the American Steel Foundries, has been appointed regional sales manager, railway division, of the Edward G. Budd Manufacturing Company, and will be in charge of a new office opened by the company in the Railway Exchange building in St. Louis, Mo. Mr. Wright is a graduate of George Washington University. His headquarters have been in St. Louis since 1926, when he took over the southwest territory as the representative of the American Steel Foundries.



John E. Wright

◆

GUSTIN-BACON MANUFACTURING COMPANY.—*E. N. Sleight*, acting manager of the Chicago office of the Gustin-Bacon Manufacturing Company, Kansas City, Mo., has been promoted to the position of manager in charge of sales in the Chicago area. Mr. Sleight graduated from Purdue University in 1931. He was later employed by the Association of American Railroads in connection with research work on chilled-steel car wheels and brake shoes. He entered the employ of Gustin-Bacon at Kansas City in May, 1937, and later that year was assigned to the Chicago office as a sales representative. In November, 1941, he was appointed acting manager of the Chicago office.

J. G. BRILL COMPANY.—*Ronald R. Monroe*, vice-president of the J. G. Brill Company, has been elected president, to succeed *Leslie E. Hess*, who is now chairman of the board. *Charles J. Hardy*, former chairman, will continue as chairman of the Executive committee. Mr. Monroe was elected vice-president of the Brill company when he joined that organization in February, 1942. He was graduated from the University of Michigan in 1915 and gained his early business experience in the middle west, where he was president of the Des Moines (Iowa) Foundry & Machine Co. for several years and director of two other manufacturing companies. He became director and executive vice-president of the Utilities Power & Light Corporation in 1935, and during the reorganization of that company served as executive assistant to the trustee. For the past several years Mr. Monroe has served on the industrial advisory committee of the Federal Reserve Bank of Chicago. He holds directorships in the Missouri Utilities Company and the Black Hills Power & Light Co.



Ronald R. Monroe

Obituary

JAMES G. BLUNT, assistant to the vice-president in charge of engineering of the American Locomotive Company, died on February 15 at Schenectady, N. Y.

◆

HENRY C. PIERLE, secretary and general sales manager of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, died on January 14 after a short illness. He was 62 years old.

◆

SAMUEL B. FORTENBAUGH, retired railway electrification engineer formerly with the General Electric Company, died on February 5. He was 73 years of age. Mr. Fortenbaugh joined the engineering department of the General Electric Company in 1906. In 1911 he went to South America on a special mission for the W. R. Grace Company, and in 1922 to Sao Paulo, Brazil, for the General Electric Company in connection with the electrification of the Paulista Railway Company. He also was engaged in electrification of railroads in South Africa and Russia. He retired in 1932.

JOSEPH S. STOCKDALE, district sales manager, Wood Preserving division, Koppers Company, Pittsburgh, Pa., died suddenly on January 19, at the age of 57. Mr. Stockdale started his business career in the engineering department of the Pittsburgh & Lake Erie Railway, resigning in 1912 to become associated with the sales department of the Pittsburgh Wood Preserving Company, which later was absorbed by the Century Wood Preserving Company, and then The Wood Preserving Corporation, now a division of the Koppers Company. Mr. Stockdale helped in the early development of the wood preserving industry and for many years he was active in the work of the American Wood Preservers' Association.

Personal Mention

General

V. H. JENKINS has been appointed supervisor maintenance of equipment of the Texas & Pacific with headquarters at Dallas, Tex.

FRANK KURZ, assistant fuel engineer of the Southern Pacific at San Francisco, Calif., has been appointed fuel engineer with headquarters at San Francisco.

F. W. BELLINGER, mechanical and electrical superintendent of the Butte, Anaconda & Pacific, has also been appointed general superintendent with headquarters as before at Anaconda, Mont.

MANUEL MANILLASIN has been appointed superintendent of motive power of the Southern Pacific of Mexico, with headquarters at Emplame, Son., succeeding M. L. Verdugo.

W. D. HARTLEY, mechanical superintendent of the Northern district, Western Lines, of the Atchison, Topeka & Santa Fe at La Junta, Colo., has been transferred to the position of mechanical superintendent of the Eastern district, Eastern Lines, with headquarters at Fort Madison, Iowa.

H. C. MCCULLOUGH, master mechanic of the Chicago, Rock Island & Pacific at Silvis, Ill., has been appointed superintendent of motive power of the Second Mechanical district, with headquarters at Kansas City, Mo.

J. E. BROWN, assistant superintendent of motive power of the St. Louis Southwestern, has been appointed superintendent of motive power, with headquarters as before at Pine Bluff, Ark.

C. H. BILTY, mechanical engineer of the Chicago, Milwaukee, St. Paul & Pacific, retired on February 28. Mr. Bilty had been in the service of the Milwaukee for 50 years. For 33 of those years he was mechanical engineer.

J. E. MCQUILLEN, mechanical superintendent of the Gulf, Colorado & Santa Fe at Galveston, Tex., retired on January 30. Mr. McQuillen was born at Rochester, N. Y., on January 25, 1873, and attended the Sacred Heart Academy, Palestine, Tex. He entered railway service in October, 1887, with the International-Great Northern as an enginehouse caller, later serving as a machinist apprentice on the I-G. N. and a machinist, foreman and general foreman in various railroad shops in the United States and Mexico. In September, 1901, he went with the G. C. & S. F. as a machinist at Temple, Tex., later becoming enginehouse gang foreman. In December, 1902, he was promoted to the position of general foreman at Gainesville, Tex., and in November, 1906, to the position of master mechanic at Silsbee, Tex. In August, 1913, Mr. McQuillen was appointed mechanical superintendent at Cleburne, Tex. His headquarters were later transferred to Galveston.

CLARKSON T. HUNT, master mechanic of the Philadelphia division of the Pennsylvania at Harrisburg, Pa., has been appointed superintendent of motive power of the Southwestern division with headquarters at Indianapolis, Ind.

BERT H. SMITH, superintendent of motive power of the Second Mechanical district of the Chicago, Rock Island & Pacific, at Kansas City, Mo., retired on February 1. Mr. Smith entered railroad service on September 1, 1894, as a machinist apprentice in the employ of the Northern Pacific at Brainerd, Minn. In May, 1904, he became enginehouse foreman of the Atchison, Topeka & Santa Fe at Chicago. One year later he was promoted to the position of division foreman, with headquarters at Marceline, Mo., later being transferred to Emporia, Kan. In 1907 he became a representative of a railway supply company, and in October, 1908, was appointed general foreman of the Chicago, Rock Island & Pacific at Caldwell, Kan. From March, 1911, to October, 1914, Mr. Smith was general foreman of the Kansas City, Mexico & Orient (now controlled by the A. T. & S. F.), going to the Rock Island as general foreman at Fairbury, Neb., in 1918. Later he served as master mechanic at various points, including Estherville, Iowa; Horton, Kan.; Little Rock, Ark., and Des Moines and in March, 1940, became superintendent of motive power at Kansas City.

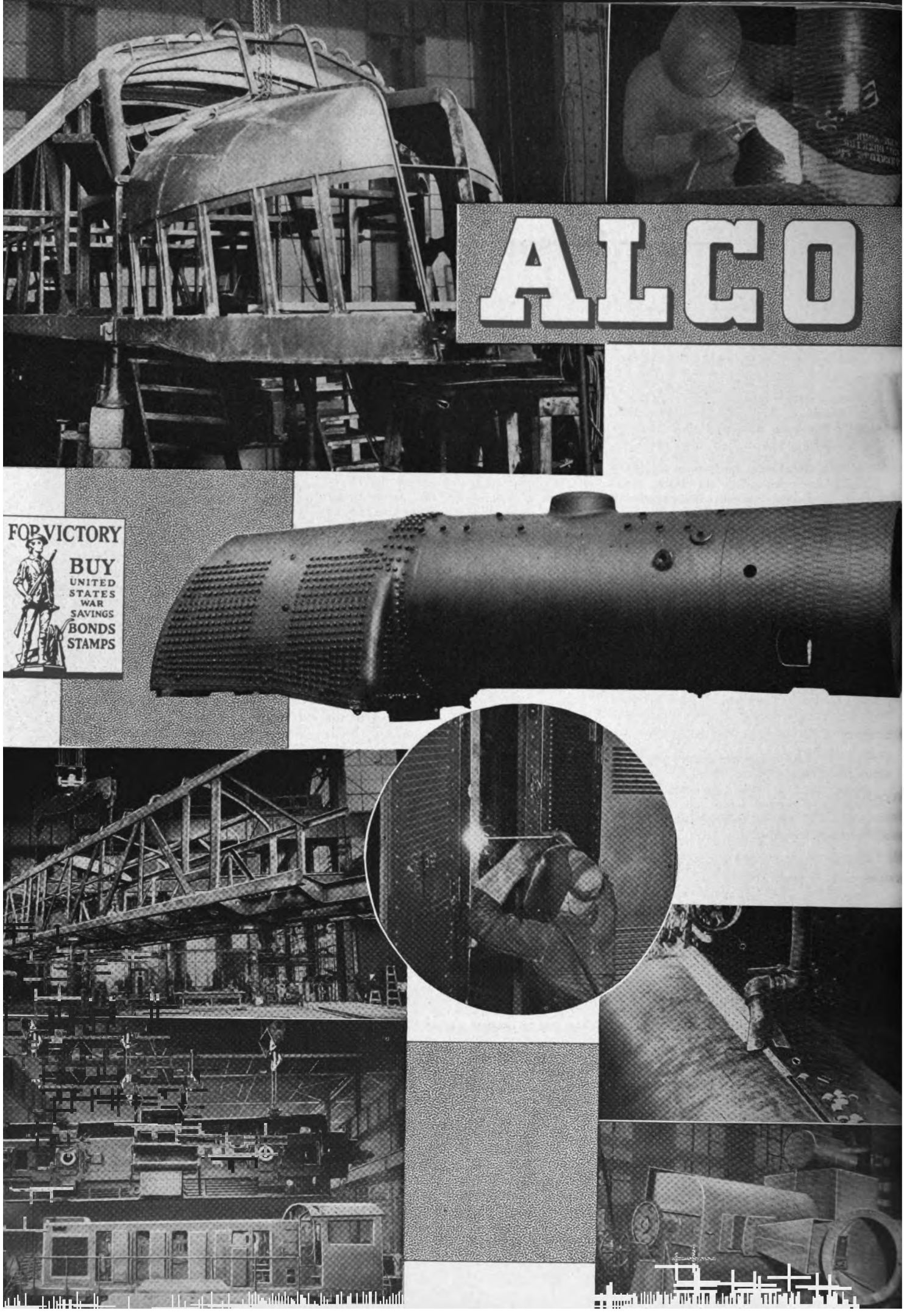
CHARLES F. NEEDHAM, assistant to the vice-president and general manager of the Central region of the Canadian National at Toronto, Ont., has retired from active railway service to accept the position of associate director of National Selective Service (civilian), at Ottawa, Ont. Mr. Needham was born on December 9, 1877, at London, Ont. He entered railroad service in 1898 as an employee in the maintenance of way department of the Grand Trunk (now Canadian National), later serving in the divisional office of the motive-power department for seven years. He was employed in the system motive power department office for 14 years as stenographer, head timekeeper, accountant, chief clerk, and special assistant to the vice-president in charge of the motive-power and car departments, respectively. Subsequently, in 1920, he was appointed assistant to the general superintendent of motive power and car departments, and from January to March, 1923, was acting assistant to the operating manager at Montreal. In the latter year he became assistant to the general manager of the Canadian National at Toronto and in 1934 was appointed assistant to the vice-president and general manager of the Central region.

F. J. HERTER has been appointed mechanical engineer of the Pere Marquette, with headquarters at Grand Rapids, Mich.

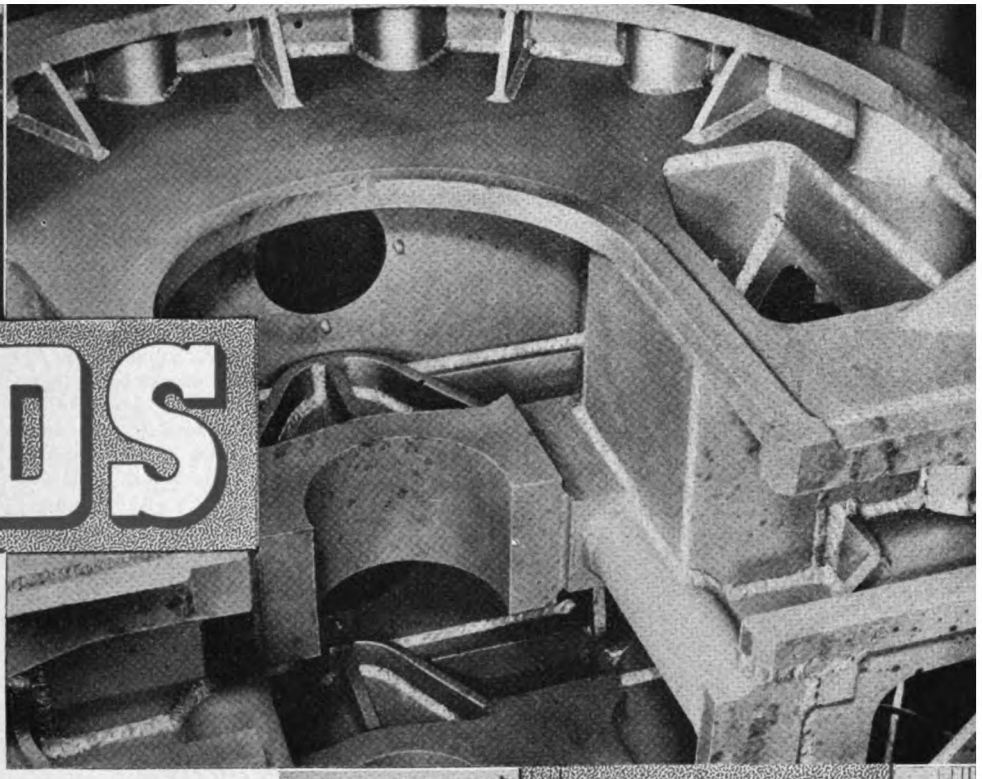
WALTER U. APPLETON, vice-president and general manager of the Atlantic region, Canadian National, has been appointed vice-president, with headquarters as before at Moncton, N. B. Mr. Appleton was born on January 29, 1878, at Moncton and entered the service of the Intercolonial as a junior clerk in October, 1890. He served successively until October, 1913, as a machinist apprentice, machinist, chief clerk, assistant to superintendent of motive power, and as general master mechanic for the Intercolonial. When the Intercolonial became a part of the Canadian Government Railways, Mr. Appleton, in February, 1918, was appointed superintendent of motive power, and in December of the same year mechanical superintendent. With the amalgamation of the Canadian Government Railways and the Canadian National System, Mr. Appleton, in September, 1920, was appointed general superintendent of rolling stock, and on March 1, 1923, general superintendent of the Atlantic region. Mr. Appleton became general manager of the Atlantic region on April 15, 1924, and in 1935 also vice-president of that region.

OSCAR G. PIERSON, mechanical superintendent of the Eastern district, Eastern Lines, of the Atchison, Topeka & Santa Fe, with headquarters at Fort Madison, Iowa, has been appointed mechanical superintendent of the Gulf, Colorado & Santa Fe, with headquarters at Galveston, Tex. Mr. Pierson was born at Topeka, Kan., on June 1, 1889, and entered railway service on April 30, 1907, as a machinist apprentice on the Santa Fe at Topeka. On April 1, 1912, he was promoted to the position of foreman of the air-brake room and two years later was transferred to Argentine, Kan., as machinist gang foreman. On February 20, 1916, he became night enginehouse foreman at Arkan-

(*Continued on second left-hand page*)


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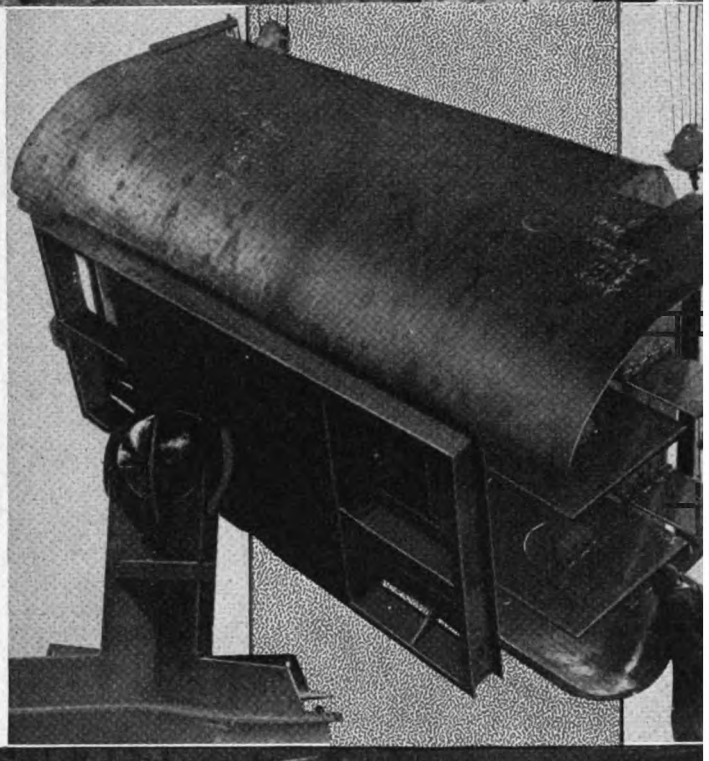
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sas City, Kan., and a year later was transferred to Argentine. Mr. Pierson resigned in December, 1917, to accept work in the Navy Yard at Washington, D. C., and on January 4, 1919, returned to



Oscar G. Pierson

the Santa Fe as a machinist at Argentine. From June 19, 1919, until November 1, 1920, he served successively as machinist gang foreman, air-brake foreman, and enginehouse foreman at Argentine. On the latter date he was appointed general foreman at Arkansas City, and on September 1, 1937, became master mechanic of the Oklahoma and Southern Kansas division. On July 15, 1939, Mr. Pierson was appointed mechanical superintendent with headquarters at Fort Madison.

Master Mechanics and Road Foremen

J. A. DEMPSTER, who has been appointed master mechanic of the Gulf, Mobile & Ohio at Jackson, Tenn., as noted in the



J. A. Dempster

January issue, was born on July 17, 1885, at Whistler, Ala. He attended public school and on June 17, 1900, entered the employ of the Mobile & Ohio (now the Gulf, Mobile & Ohio), as a machinist apprentice. He was an M. & O. machinist from June 17, 1904, until October, 1906, when he became a machinist in the employ of the Missouri Pacific. He returned to the M. & O. as a machinist on December 26, 1906; in February, 1913, became gang foreman; on October 15, 1913, general foreman, and on November 1, 1942, master mechanic.

J. T. GAGHEN has been appointed master mechanic of the Illinois Terminal at Alton, Ill.

P. J. DANNEBERG, master mechanic of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed mechanical superintendent at La Junta, Colo. Mr. Danneberg was born at Argentine, Kan., on October 12, 1894, and entered railroad service in 1909 as a wheel checker in the employ of the Santa Fe at Argentine. He subsequently served as machinist, assistant enginehouse foreman, machinist gang foreman and enginehouse foreman and in 1922 became general locomotive foreman



P. J. Danneberg

at Argentine. In 1937 Mr. Danneberg was appointed master mechanic at Slaton, Tex., being transferred to Clovis, N. M., in 1939, to Winslow, Ariz., later in 1939, and to Argentine in 1941.

FRANK L. HAMM has been appointed assistant road foreman of engines of the Long Island, with headquarters at Morris Park, L. I.

ARTHUR MEEHAN has been appointed road foreman of engines of the Canadian National, with headquarters at Riviere a Pierre, Que.

J. W. MASON, foreman of the erecting shop of the Central of Georgia, at Macon, Ga., has been appointed assistant master mechanic at Macon.

F. N. BURCH, assistant master mechanic of the Macon (Ga.) shops of the Central of Georgia, has been appointed to master mechanic of the Macon shops.

R. E. DETRICK, master mechanic of the Chicago, Rock Island & Pacific at Armourdale, Kan., has been transferred to the position of master mechanic at Silvis, Ill.

C. I. CLUGH, acting chief inspector in the test department at the Altoona, Pa., works of the Pennsylvania, has been appointed master mechanic of the Philadelphia terminal division, with headquarters at Philadelphia, Pa.

C. E. FARLEY, master mechanic of the Chicago, Rock Island & Pacific, at Des Moines, Iowa, has been transferred to the position of master mechanic at Armourdale, Kan.

F. J. SCHLEIHS, master mechanic of the Chicago, Rock Island & Pacific at Dalhart, Tex., has been transferred to the position of master mechanic at Des Moines, Iowa.

C. W. WHISTLER, JR., master mechanic of the Philadelphia terminal division of the Pennsylvania at Philadelphia, Pa., has been transferred to the position of master mechanic of the Philadelphia division, with headquarters at Harrisburg, Pa.

H. J. CROWLEY, road foreman of equipment of the Missouri-Kansas division of the Chicago, Rock Island & Pacific, has been appointed master mechanic at Dalhart, Tex.

H. M. WATERS, an engineer in the employ of the Central of Georgia, has been promoted to the position of road foreman of engines, Macon division, with headquarters at Macon, Ga.

WILLIAM GEORGE GRAY, who has been appointed master mechanic of the Virginian with headquarters at Elmore, W. Va., as announced in the February issue, was born on April 26, 1904, at Lehighton, Pa. He received the degree of B.S. in Industrial Engineering at Pennsylvania State College in 1926 and in September of the same year



W. G. Gray

entered railway service as a special apprentice at the Packerton, Pa., shop of the Lehigh Valley, being transferred in September, 1928, to Sayre, Pa., shop as apprentice instructor. In September, 1929, he was transferred to the office of mechanical engineer, where he worked on various design problems and analyzed road test data both for cars and locomotives. He became car foreman at the Oak Island shop in August, 1930; night foreman in the train yard at Sayre in September, 1931; assistant general foreman, passenger-car shop at Sayre in November, 1931; general supervisor, freight-passenger repairs, in April, 1932, and special engineer in the office of the superintendent of motive power in June, 1937. On January 1, 1939, Mr. Gray left the service of the Lehigh Valley to become engineer freight-car design for the Union Pa-

cific at Omaha, Neb., and on May 1, 1940, was appointed assistant mechanical engineer, Mechanical Division, Association of American Railroads. His service with the Virginian began on October 1, 1941.

S. O. LEWIS has been appointed road foreman of engines of the Baltimore & Ohio, with headquarters at Brunswick, Md.

HARRISON L. PRICE, superintendent of the car shop of the Atchison, Topeka & Santa Fe at Chicago, has been appointed master mechanic with headquarters at Chanute, Kan.

JAMES W. ATKINSON, master mechanic of the Atchison, Topeka & Santa Fe at Fort Madison, Iowa, has been transferred to the position of master mechanic at Argentine, Kan.

G. D. JONES, master mechanic of the Atchison, Topeka & Santa Fe at Chanute, Kan., has been transferred to the position of master mechanic at Fort Madison, Iowa.

Car Department

FRED WIRE, general car foreman of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed superintendent of the car shops at Chicago.

W. G. PALMER has been appointed superintendent of car shop of the Central Region of the Canadian National, with headquarters at London, Ont.

C. F. WEAVER, superintendent of car shop of the Central region of the Canadian National at London, Ont., has been appointed assistant general superintendent of car equipment, with headquarters at Toronto, Ont.

GEORGE E. MCCOY, assistant general superintendent of car equipment, Central region, of the Canadian National at Toronto, Ont., has been appointed assistant chief of car equipment, with headquarters at Montreal, Que. Mr. McCoy was born on January 8, 1886, at Moncton, N. B. He entered railroad service in 1900 as a



George E. McCoy

mechanical draftsman apprentice of the Intercolonial (now Canadian National), serving in that capacity until 1905, when he became draftsman. In 1914, he was promoted to the position of assistant chief draftsman of the Canadian Government Railways (now Canadian National), becoming assistant master car builder in 1916. He was appointed master car builder of the Eastern lines of the Canadian National in 1918; superintendent of car equipment of the Atlantic region in 1923; general superintendent of car equipment of the Atlantic region, with headquarters at Moncton, in 1928, and assistant general superintendent of car equipment of the Central region at Toronto in 1932.

ERIC WYNNE, supervisor of special mechanical work at the Fort Rouge shops of the Canadian National at Winnepeg, Man., has been appointed mechanical inspector, with headquarters at Montreal, Que.

G. C. MAYNARD, air brake inspector of the Canadian National at Toronto, Ont., has been appointed chief inspector of air brakes, with headquarters at Montreal, Que.

Shop and Enginehouse

WALTER R. LANUM, enginehouse and boiler foreman of the Central of Georgia at Macon, Ga., has retired.

HERBERT PARKER, shop draftsman in the employ of the Canadian National at Stratford, Ont., has been appointed supervisor and examiner of apprentices at Stratford.

JULIAN CROSSLEY, wheel shop foreman of the Central of Georgia at Macon, Ga., has been promoted to the position of erecting shop foreman at Macon.

R. G. JEFFERSON, shop foreman of the Central of Georgia, at Savannah, Ga., has been appointed enginehouse and boiler foreman, with headquarters at Macon, Ga.

BENJAMIN F. TYNER, a machinist in the employ of the Central of Georgia at Macon, Ga., has been promoted to the position of wheel shop foreman at Macon.

Purchasing and Stores

W. F. BROWN, chief clerk of the general storekeeper's office of the Wabash, has been appointed acting general storekeeper during the absence of C. L. Wakeman, who has entered military service.

T. F. LYNCH has been appointed general storekeeper of the St. Paul & Sault Ste Marie, with headquarters at Minneapolis, Minn.

E. J. LEONARD, traveling storekeeper of the Chicago & North Western, has been appointed assistant general storekeeper, with headquarters as before in Chicago.

JESSE B. BOYES, purchasing agent and general storekeeper of the Minneapolis, St. Paul & Sault Ste. Marie, the Duluth South Shore & Atlantic, and the Mineral Range, with headquarters at Minneapolis, Minn., retired on January 1.

T. J. RUTH has been appointed acting purchasing agent of the Minneapolis, St. Paul & Sault Ste. Marie, the Duluth, South Shore & Atlantic and the Mineral Range, with headquarters at Minneapolis, Minn.

Obituary

S. TWOGOOD, fuel engineer of the Southern Pacific at San Francisco, Calif., died in the Southern Pacific hospital at San Francisco on January 16.

THOMAS ALEXANDER JOHNSON, master mechanic of the Central of Georgia shops at Macon, Ga., died at a hospital at Macon on January 24, at the age of 56.

WILLIAM J. MILLER, superintendent of motive power of the St. Louis Southwestern, with headquarters at Pine Bluff, Ark., died in that city on January 27. Mr. Miller was born at Philadelphia, Pa., on August 27, 1867. He entered railroad service in 1881 as a machinist apprentice of the Hannibal & St. Joseph (now a part of the Chicago, Burlington & Quincy), and in March, 1886, became a machinist in the employ of the Missouri Pacific. He held similar positions on the Missouri-Kansas-Texas, the Atchison, Topeka & Santa Fe and the Wabash until, in 1897, he was appointed master mechanic of the St. Louis Southwestern at Pine Bluff. In 1914, Mr. Miller was appointed superintendent of motive power.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

"LADY, WILL YOU GIVE A LIFT?"—The Elwell-Parker Electric Company, Cleveland, Ohio. Instruction pamphlet for women operators of power industrial trucks.

◆

CARBIDE GRINDERS. — Hammond Machinery Builders, 1648 Douglas avenue, Kalamazoo, Mich. Bulletin No. 201. Full information on Hammond carbide grinders and their maintenance.

◆

"WELDING AND BRAZING ALCOA ALUMINUM."—Aluminum Company of America, Pittsburgh, Pa. Completely rewritten edition of welding booklet, incorporating the art of brazing. One hundred pages, illustrated, spiral bound. Explains correct use and working of aluminum. Sections on Welding Alcoa Aluminum; Arc Welding; Inspection and Specifications—Gas and Arc Welding; Electric-Resistance Welding; Brazing Alcoa Aluminum.

◆

THREAD-MILLING CUTTERS.—Barber-Colman Company, Rockford, Ill. Sixteen-page bulletin, entitled "Facts About Multiple Thread-Milling Cutters." Clarifies some of the problems connected with ordering, manufacturing and the use of thread-milling cutters under war-time conditions. Shows by pictures and diagrams, with concise descriptive information, how various types of thread-milling cutters are designed, set up, sharpened and used for most satisfactory results.



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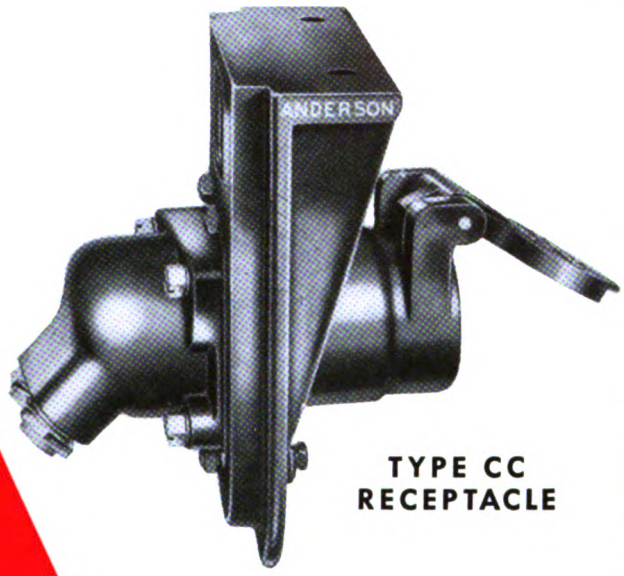
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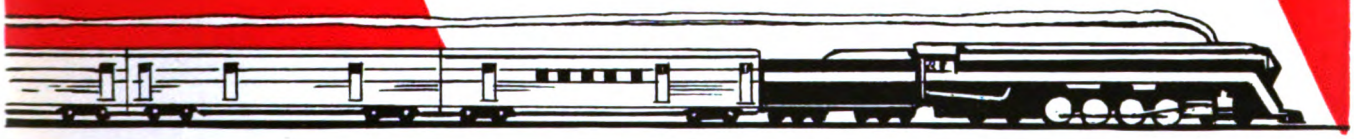
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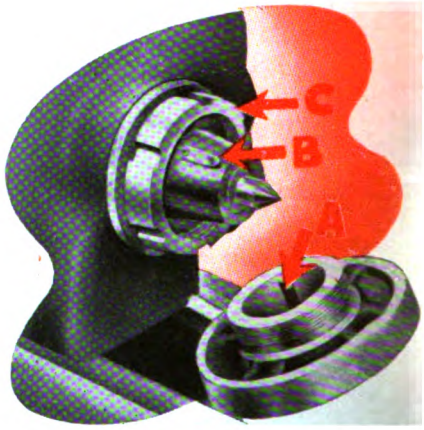
USING A CHUCK

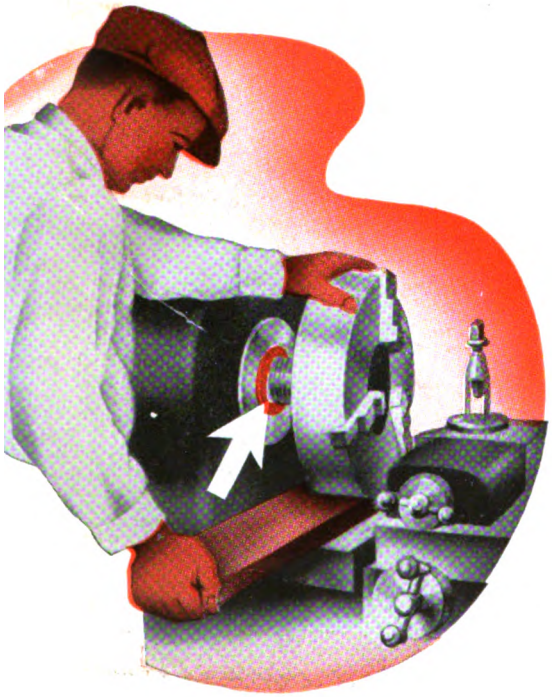
Generally speaking, a chuck is used when the piece to be machined is irregular in shape; large in diameter in proportion to its length; so long as to require its being passed through the spindle; or when it is to be bored or drilled on the lathe axis.

On many lathes more than seven years old, there is a threaded spindle which requires some special handling when you put on or take off a chuck. On today's modern lathe this thread has been replaced with a standard taper spindle nose. Here is the procedure for putting on both types.

TAPER SPINDLE NOSE

Simply place chuck on spindle nose with slot (A) fitted over key (B). This leaves both hands free to start and tighten collar (C). On or off the operation takes 12 to 15 seconds and is practically fool-proof.





OLD TYPE THREADED SPINDLE NOSE

Don't put chuck on with the lathe running. It is dangerous to the operator and bad for the thread.

Hold chuck up to nose and revolve spindle by hand until engaged, then run chuck on by hand. If the chuck is too heavy for steady handling, place on a board across wings of carriage, using the board as a lever to raise chuck in alignment with threaded nose.

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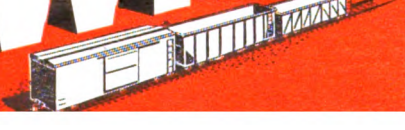


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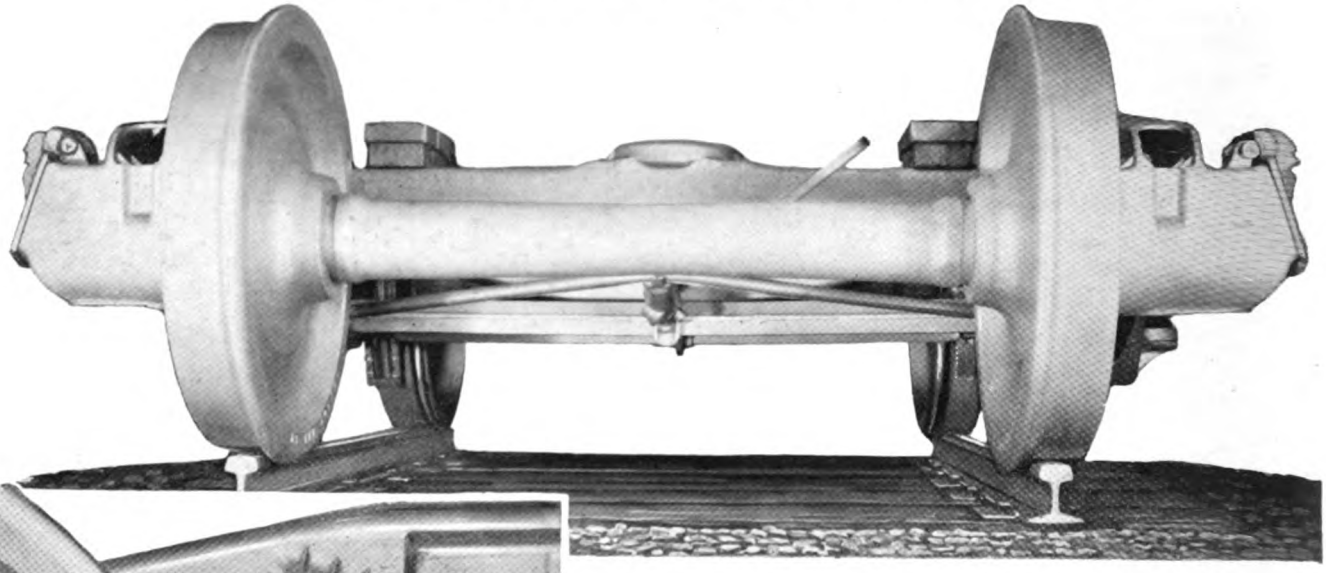
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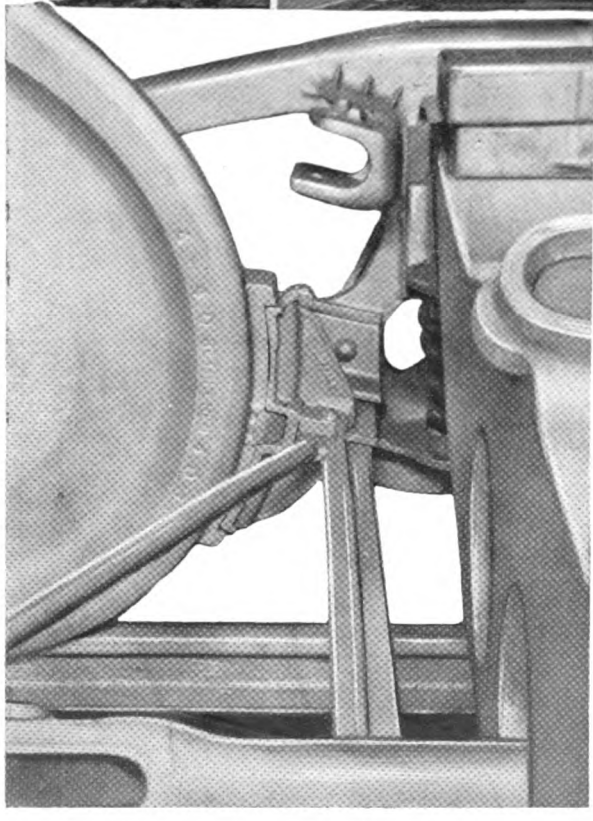


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"Because I'm going to hit right from the shoulder, starting now.

"Out there, our boys are fighting, and they're falling. Not one or two at a time, picked off by a nice clean bullet. But fifty at a time in the roaring, flaming hell of a shell burst.

"Out there, they aren't walking around in clean white uniforms on neat decks. They're running and slipping around on the bloody heaving flanks of a carrier foundering in a sea of oil with her guts torn out.

"They're not lying in cool, immaculate hospital beds with pretty nurses to hold their hands. They're flat on their backs on cold steel taking a smoke and waiting for a doctor to get through with the *seriously* wounded.

"Out there, they're fighting and they're falling but they're winning! And get this straight—they're not complaining. But I want you to know what they're up against. I want you to know they look to you to give them in *your* way the same full measure of help and devotion they get unasked from their own shipmates.

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THE EDITOR'S DESK

AFTER THE WAR

We have been hearing a great deal for many months about post-war economic planning, with a view to stabilizing business, industry and employment. Many groups, private and governmental, as well as individual corporations, are devoting much time and attention to these post-war problems. A governmental agency, the National Resources Planning Board, has already sent recommendations to Congress. These particular reports, incidentally, are of the typical New Deal type and tend toward the future adoption of government ownership and operation of transportation.

What, if anything, is being done to offset this tendency toward government ownership? An exhaustive answer cannot be given here, but mention may be made of two significant movements which should receive the co-operation and support of those who are interested in maintaining that fundamental upon which this country has been developed—the spirit of free competitive private enterprise.

One group, the Committee on Economic Development, which is privately financed, recognizes the fact that production and employment must be maintained at a high level in the post-war era; otherwise there is a grave probability that we may be driven to a planned economy or collectivism—an outstanding characteristic of the Axis nations, with which we are today battling. It has its headquarters in the Commerce Department Building at Washington and is definitely planning and busily working on a constructive program to prevent such a catastrophe.

Another group, the Transportation Association of America, has recently retained ex-Congressman Samuel B. Pettengill as its vice-president and general counsel. It recognizes the dangerous New Deal trend toward government ownership and collectivism. It recognizes, also, that the first inroads will be made upon transportation, and particularly upon the railroads. The heavy industries will come later. In light of this it apparently intends to concentrate its attention upon the prevention of government ownership of the railroads. Few men, if any, are so well equipped to lead an effort of this sort as Mr. Pettengill, because of the long and active part that he has taken in sponsoring good railroad legislation.

It would appear that one other job remains to be tackled, although no specific organization seems to have made much headway with it thus far; that is, to eliminate or effectively control the great number of bureaus that, once established in either federal or state governments, gradually reach out their tentacles and, at needless waste and expense to the taxpayers tend to usurp the functions of government.

Here are worthwhile tasks that require our hearty participation and co-operation.

Roy V. Wright

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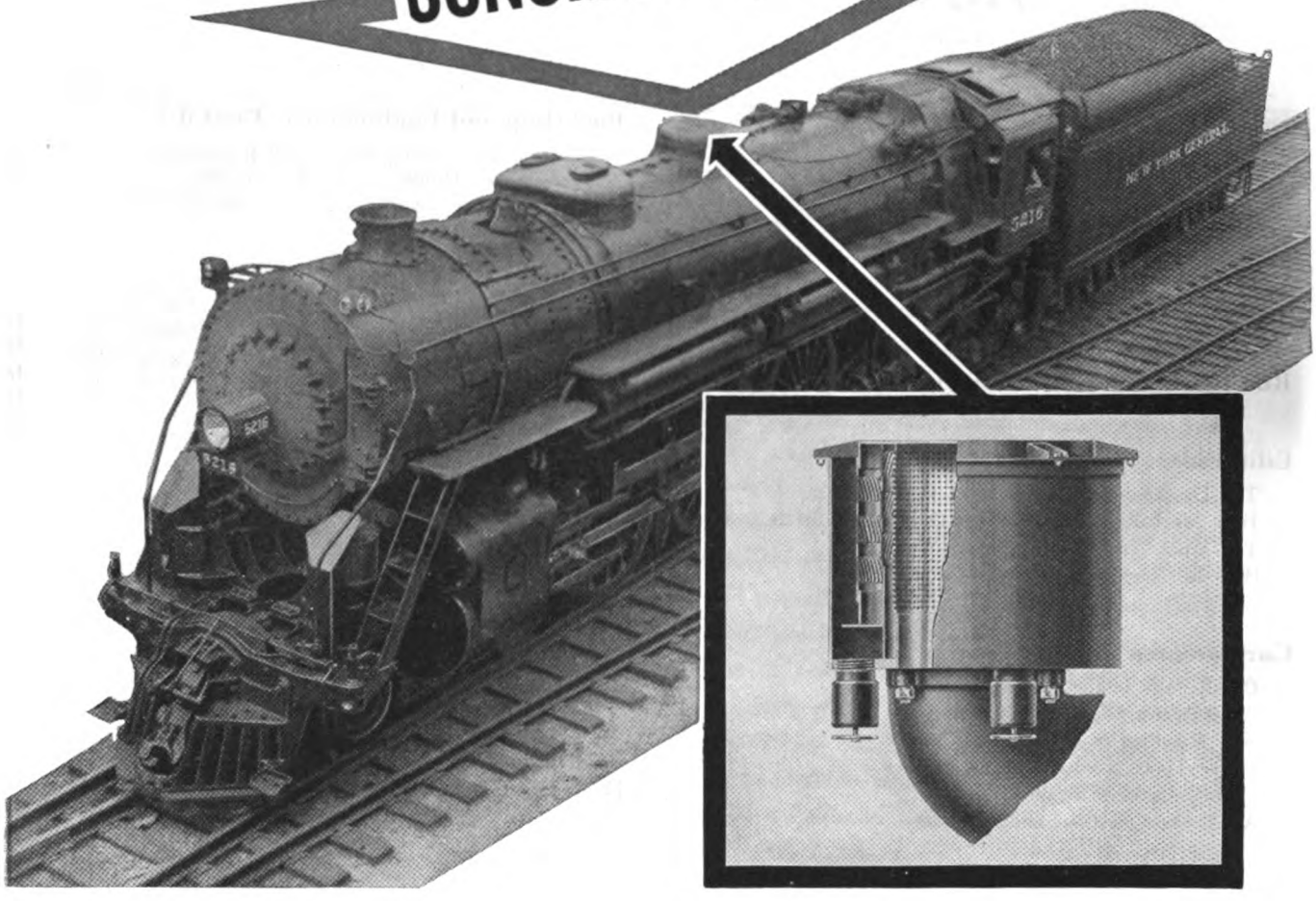
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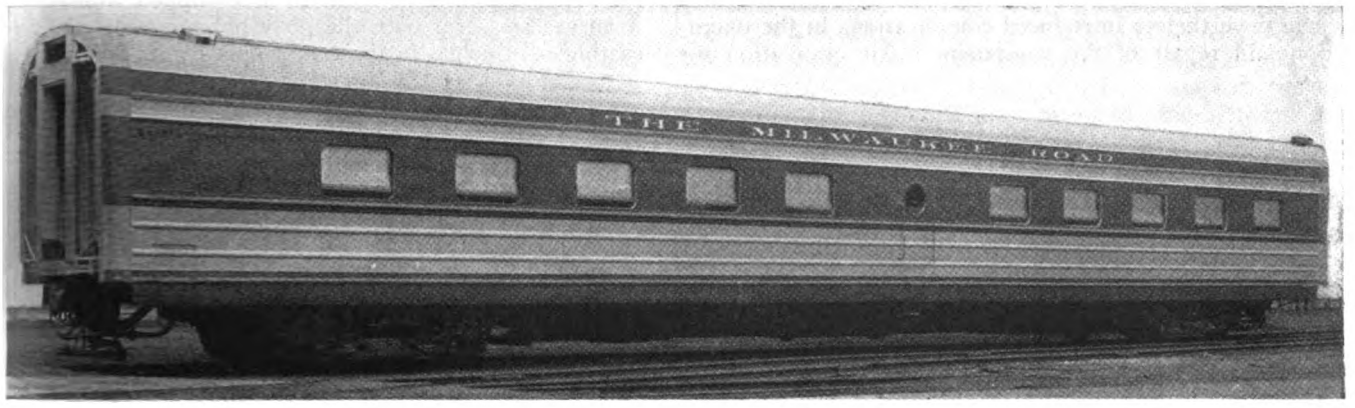
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One of the auxiliary dining cars

1942-Built

Milwaukee Passenger Cars

Thirty-one cars turned out of Milwaukee shops do yeoman service in helping the railroad handle 74 per cent more traffic than in 1941—Trucks are another step in evolution started on this road in 1938

THE Chicago, Milwaukee, St. Paul & Pacific built last year at its company shops, Milwaukee, Wis., 31 new welded all-steel passenger cars, including 2 diners, 2 auxiliary dining cars, 2 passenger-baggage cars and 25 coaches. This new equipment, built primarily for the Hiawatha, constitutes the fourth edition of the train since it was first inaugurated in May, 1935, and includes entirely new equipment except for the parlor and beavertail cars. The replaced cars, substituted in other trains, helped meet the urgent demand for additional passenger equipment and undoubtedly were an important factor in enabling the Milwaukee to handle a record-breaking passenger traffic, both war and civilian, in 1942. The number of passenger miles increased from over 565 million in 1941 to about 984 million in 1942, or roughly 74 per cent.

Authority for building this new equipment was given early in 1941 and some material was ordered at that time. However, where improvements were under development, the ordering was necessarily delayed and, as war requirements increased, one material after another was made unavailable for passenger-car construction. As a result, innumerable substitutes were required which made construction of the cars difficult from a production standpoint and seriously added to the car weight. Low-alloy, high-tensile steel was obtained for only a portion of the car parts. In past designs, aluminum had been extensively used for air-ducts, piping, hardware, etc., and in its place low-carbon steel had to be employed. For instance, steel tubing was used for all furniture in place of aluminum; hair and spring upholstery in place of rubber; windows had to be made without the use of either brass or aluminum; many car specialties including coach seats and lighting fixtures were not obtainable from the usual sources of supply and substitutes were made and fabricated at Milwaukee shops.

The new cars include as special features an improved truck design with Budd disc-type brakes; redesigning the car body to meet both the original Post Office Department specification and the latest revised A.A.R. specification for passenger cars; adding of skirts to the car body; redesigning vestibule diaphragms and face plates; introduction of a connecting tunnel diaphragm in the vestibule; insulation of draft gears; use of Waukesha propane-engine-driven air-conditioning and lighting equipment; new design of coach seats; improved heating; fluorescent lighting; new window construction, and new interior finish material.

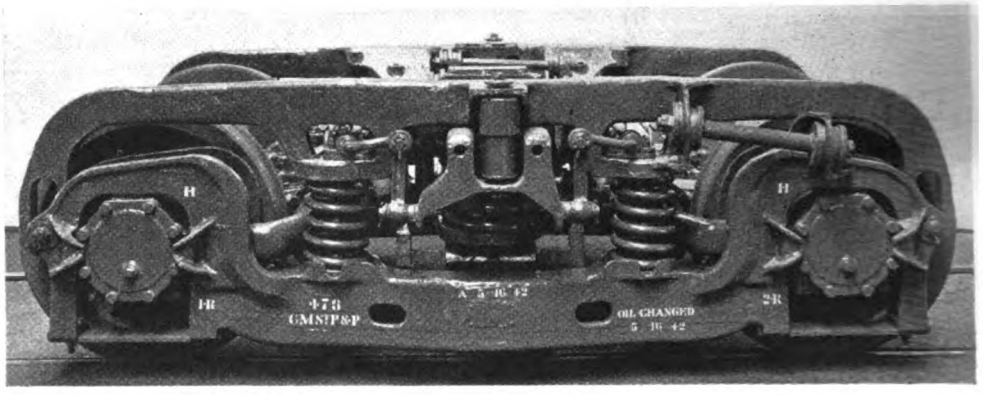
Considerable cross-sectional area was added in the car body to meet the two specifications mentioned which were treated as separate engineering problems. To

comply with these specifications, it was deemed necessary to increase the cross-sectional area in the roof considerably so that the component of buffing stresses carried by the underframe would be balanced in the roof. The introduction of the skirts also added to the weight of the car and unfortunately, although exceptional care was taken to insulate the car from a sound-deadening standpoint, the noise level is somewhat higher than the low point achieved in cars previously built. While the skirts undoubtedly add to the appearance of the car, they have nevertheless introduced complications in the operation and repair of the equipment. Air circulation for cooling purposes is restricted in summer and especially in winter when tons of ice accumulate on the car underframe, a condition not experienced with previous cars.

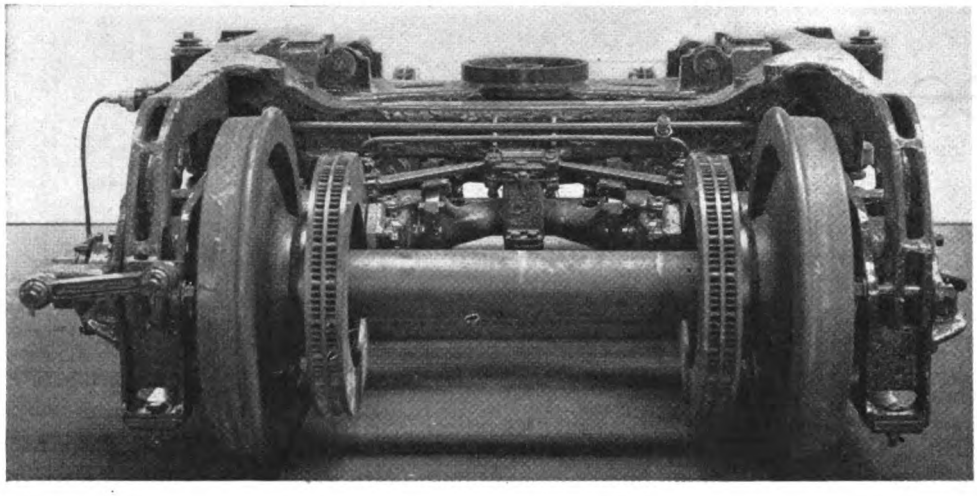
The same general type of welded steel construction is used in these cars as in previous Hiawatha equipment, the length being about 82 ft. over coupler pulling faces; width over side posts, 10 ft.; and height, 13 ft. 1 in. to the top of the rail. The passenger-baggage car, with a 36-ft. baggage room and a passenger compartment seating 40, weighs 125,700 lb. Other car weights are as follows: Coach, 126,700 lb.; auxiliary diner, 129,000 lb.; diner, 139,500 lb. The figures given are ready-to-run weights.

The coach has a main passenger compartment 48 ft. 10 in. long, seating 56 and a smoking lounge in one end seating 12, thus giving a total seating capacity of 68. The usual modern wash-room facilities are available in the other end of the car. The auxiliary diner has a 29-ft. compartment in either end with a seating capacity of 26 each, separated by a 9-ft. 4-in. buffet section well equipped to serve lunches and refreshments to a large number of civilian passengers or military personnel as required. The dining car seats 48 in the main room; it has a 9-ft. 6-in. pantry and an 18-ft. 9-in. kitchen.

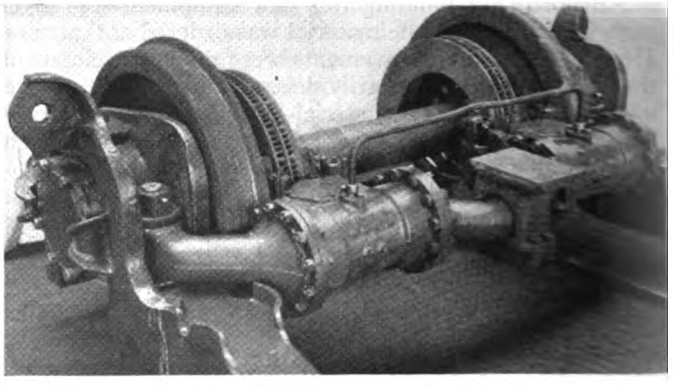
Each car roof consists of four sub-assemblies of two side plates, two short-radius side plates and two long-radius top sections. These sub-assemblies are built 39 ft. 9 in. long and then fabricated into a completed roof on the roof jig. The side frame is constructed with a two-element side sill, one welded into the side frame and the other into the underframe. The entire car frame is spot and arc welded. The car is equipped with a platform cast integral with the body bolster. The platform casting is attached to the center sills by welding beyond the center plate. All underneath equipment is attached to the center sill and concentrated as nearly as possible at the center of the car, A.A.R. tight-lock couplers furnished by the Buckeye Steel Castings Company are installed. For the first time in Milwaukee practice, the



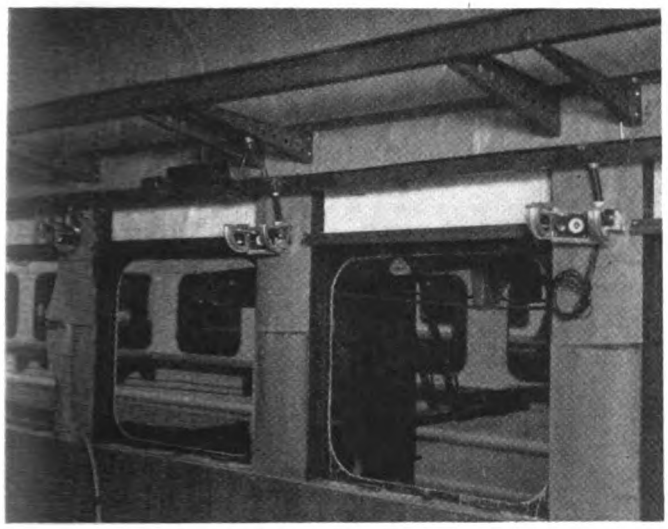
The four-wheel truck has relatively light frames



The truck frame is laterally positioned by links to one of the equalizers



Details of the Budd brake application



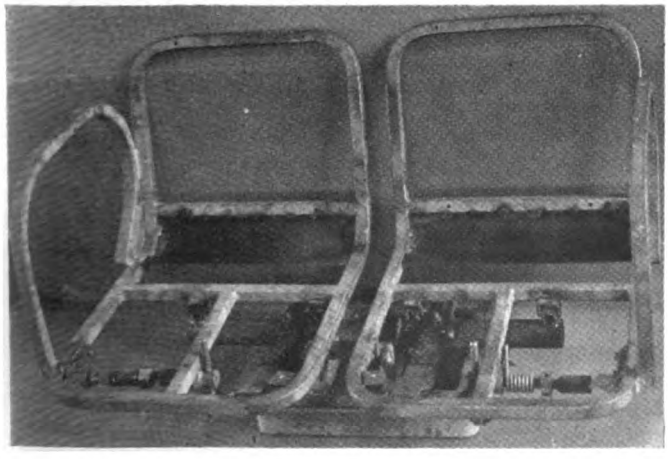
How the lighting fixtures and basket racks are installed

cars are equipped with skirts 15⅞ in. deep extending the full length of the car. The skirt is the full depth even at the steps. Doors are cut into this skirt for the removal and inspection of the underneath equipment.

In order to assure a well-insulated car, Fiberglas, 2½ in. thick, is applied in the floors of 11 coaches and Stonefelt in the balance of the car floors. Car sides, roof and ends are protected by a 2½-in. thickness of Stonefelt, applied in the form of a continuous blanket with just as few breaks in the material as possible. Liquid asphaltum is sprayed on the inside surfaces of metal sheets for insulation and sound deadening. Felt stripping is applied between inside finish and the side posts. Cork board, 2½ in. thick, is used to insulate ice boxes, bottle lockers, etc. Where necessary, piping is insulated by the application of Wovenstone pipe covering.

Features of the Truck Design

The trucks represent several years of research and experimental work on the Milwaukee, the first part of which was described in an article beginning on page 862 of the Railway Age issue of May 20, 1939. Eventually a car set of cast-steel trucks, embodying new principles of design, was developed and secured from the General Steel Castings Company. The outstanding feature is the use of equalizers extended to include the functions of conventional pedestal jaws. With the exception of the contact with the roller bearing housing at the top



Tubular steel frame of one of the new coach seat units

forming a lateral pivoting point, there is no contact or wearing surface between the box and the equalizer.

The wheels, axles and bearings are oriented with respect to the truck frame by the use of drawbars and the Budd brake C-frame, the latter being modified so that it is not necessary to remove any part of the brake frame in order to change a pair of wheels. The inner element of the early type of two-element journal box, so successfully used on Milwaukee passenger cars, forms a crowned inner housing for the Timken roller bearings. Urschel-Pittsburgh hollow heat-treated carbon-steel axles are used. With the introduction of this axle and the maintenance of 6-ft. 4-in. journal spacing for trucks of all capacities including 6 in. by 11 in., the Milwaukee has adopted one standard roller bearing and will gradually have one standard axle on 350 roller-bearing cars, a highly-important advantage from a coach-yard maintenance standpoint.

The bolster coil springs of the truck, 13⅝ in. in outside diameter, have a free height of 22⅜ in. and a riding height of 13½ in. This high free to load deflection gives the low frequency rate needed when the car is operating at high speeds. The coil springs are controlled at their unstable period, between 5 and 10 miles an hour, by Monroe hydraulic shock absorbers designed for approximately 2,000 lb. on rebound and 600 lb. on compression at the natural period of the spring. The shock absorbers are stem mounted between the truck



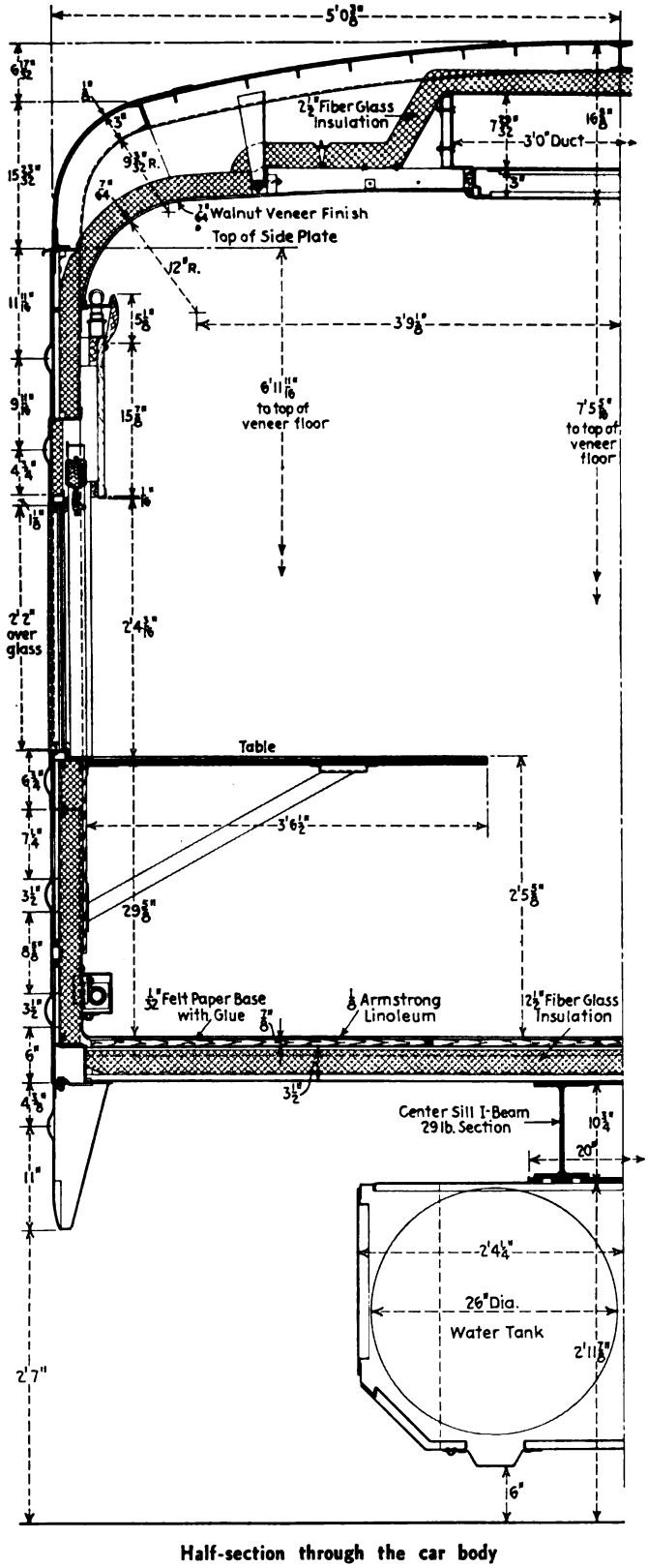
Side wall, ceiling and air duct insulation applied in blanket form

frame and bolster. The car-body side bearings are 1-in. rubber sandwiches with ⅛-in. steel plate on top and ⅜-in. spring steel plate on the bottom bonded to the rubber.

The truck frame does not have pedestals or tail pieces but does extend to the rear of the bearing for safety in case of a broken equalizer or equalizer spring. The derailment safety bolts, securing the frame to the equalizer, are also at the end of the truck frame. The trucks are equipped with Monroe 1⅜-in. spring steel levelator bars. There are two bars per truck which have a leveling power of approximately 900 lb. per in. at the car body side sill. These bars are well insulated from the truck bolster by the use of resilient bushings. Houde lateral shock absorbers are mounted between the bolster and the spring plank controlling the lateral motion of the large bolster coil spring on the passenger-baggage cars, diners and auxiliary diners.

The Rolokron anti-wheel slide device, developed by the Budd Wheel Company, is applied to the truck with

the registers mounted in place of the roller bearing box covers, and a control box mounted under the car body. The register flywheel is spring driven from the end of the axle. When the retardation rate reaches between 15 and 20 m. p. h. per sec., the driving spring is sufficiently compressed to close a set of contacts which energizes the solenoid valve of the control box. This solenoid valve is a three-way valve controlled by a relay in such a way that the brake-cylinder pressure is exhausted for one second. At the same time the air from the triple valve is shut off. At the end of the one-second interval, the relay valve de-energizes the solenoid, allowing the air from the triple valve to be restored to the brake cylinder. The wheel by this time should be again traveling at relative track speed. If the wheel again tends to slide, this process will be repeated.



Half-section through the car body

The air brakes are Westinghouse Schedule H.S.C.

Improvements in passenger truck design, as exemplified in the new Milwaukee truck include: (1) Entire elimination of center plate wear by the introduction of heavy bonded steel-rubber pads, which make lubrication unnecessary and, in fact, undesirable; (2) side bearing adjustment eliminated by the use of thick bonded steel-rubber pads which are applied with a light initial compression; (3) elimination of elliptic springs with their unknown frictional resistance and replacing them with large helical bolster springs of constant capacity; (4) elimination of pedestal liners with consequent wear on liners and journal boxes; (5) elimination of friction plates between bolsters and transoms and controlling the movement of bolsters by means of rubber-mounted bolster drawbars and levelator bars; (6) positioning the equalizer with respect to the truck frame by means of lateral and longitudinal rubber-mounted drawbars.

Realization of the improvements mentioned has resulted in a practically noiseless design and eliminated all wear in contact surfaces in the entire truck with the exception of the pins supporting the spring plank hangers. By virtue of the lateral flexibility of the large equalizer springs, the wear of the spring plank hangers and pins is materially reduced. Although the truck was designed to be interchangeable with the heaviest cars in Milwaukee service and a liberal allowance was made in the design of the axles, the total weight for two complete trucks is 34,080 lb.

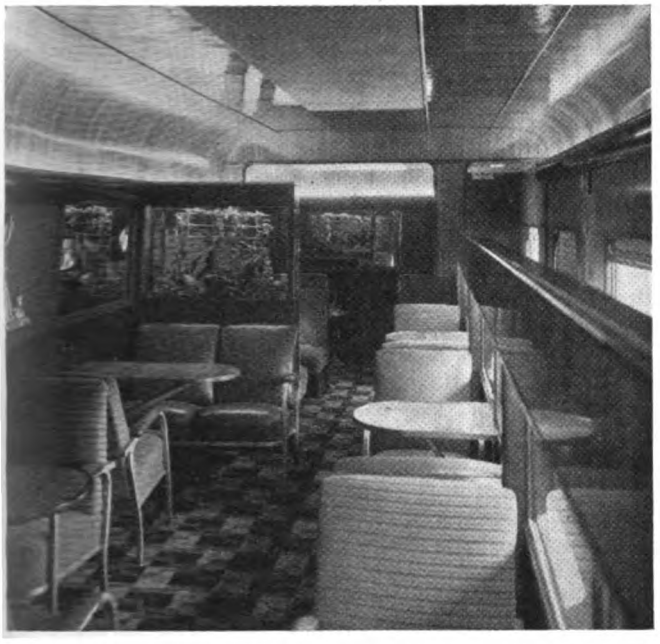
Each of the friction draft gears, of the Miner type, is held in a cast-steel enclosure attached to the platform casting through three-well-insulated connectors. The draft gear functions in a normal manner inside the enclosure. The use of the enclosure affords large surfaces for the insulators which would not be possible with the usual construction.

The buffer stem has been pinned back so that it does not contact the buffer channel until the draft gear has been compressed ¾ in. This insulates the buffer center stem from the buffer channels by the simple expedient of avoiding contact except under extreme conditions. The high absorption value of the buffer is still retained for safety in collision. The buffer diaphragm face plate and the outside enclosure face plate are held together by means of insulated links. This assembly is in turn mounted on the car body by an insulated adjustable link. The outside enclosures are No. 6 canvas.

The Air-Conditioning Installation

Air-conditioning equipment consists of a Waukesha Model-D heavy-duty four-cylinder internal combustion engine with four-cylinder V-type refrigerant compressor, having a capacity of 7½ tons in 24 hrs. and using Freon as a refrigerant. A sub-cooler is also installed to provide maximum capacity in extreme weather. The fuel system consists of a four-cylinder cabinet, propane cylinders and necessary valves.

The ice engine, sub-cooler and fuel cabinet are located directly under the center of the car. The ice engine can be rolled out to clear the side of the car on specially constructed tracks, supported from the side sill of the car, the skirt at this point being easily removable. This equipment employs a split evaporator which functions



Interior of auxiliary diner equipped to serve lunches and refreshments

to keep a more uniform load on the compressor by cutting out two-thirds of the evaporator coils when the desired car temperature is approached. It also tends to maintain a more uniform humidity.

At one end of each car, a Young Radiator Company's overhead roof-mounted blower unit is installed, constructed according to specifications submitted by the railroad. The blower capacity is 2,000 cu. ft. per min. with 0.7-in. W. G. external resistance, the cooling coil being copper-tube fin-type type with a working pressure of 400 lb. per sq. in. and a maximum suction pressure of 38 lb. per sq. in. The design calls for 550 cu. ft. per min. of fresh air, outside temperature 96 deg. F. dry bulb; 78 deg. F. wet bulb; inside temperature 74 deg. F. dry bulb, 60 deg. F. wet bulb. The overhead unit is mounted on four rubber vibration insulators on metal supports fastened to the roof carlines. Accessibility is afforded by means of a roof hatch for removing the unit proper.

Fresh air is taken into the car at the vestibule end through an opening in the end sheet and by-passes itself to a plenum chamber where three 15⅞-in. by 19⅞-in. by 4-in. Farr air filters are mounted in an inclined position to obtain as much free area as possible. In addition a 22-in. by 11-in. recirculating grill opening is located directly underneath the plenum chamber to maintain proper balance between the fresh and the recirculated air. Air delivery is through Pyle-National Multi-vent center ceiling panels.

Electric power for lights and accessories is secured from a Waukesha heavy-duty four-cylinder internal combustion engine with directly connected mechanically-cooled generator of special design, having heavy-duty roller bearings, fully enclosed. Fuel is obtained from the same cabinet that supplies the ice engine. The propane cylinders are unloaded in sequence by the usual controls. The engine is started and stopped automatically in accordance with the electrical load by means of controls on a suitable panel on the generator unit. This unit is mounted in the same manner as the ice engine and can also be rolled out for servicing.

A 2.5-kva. Safety Car Heating and Lighting Company's single-phase 60-cycle motor-alternator is installed to furnish 110-volt current to lights and outlets This unit is also attached to the center sill. Starting power for the ice engine and generator is furnished by Exide batteries carried in a box under the center sill. The installation includes A. & J. M. Anderson charging receptacles.

The cars are heated by the latest type Vapor Car Heating Company's zone-control system. This method of car heating employs the use of several zones or areas, each with its own thermostat and thus assures a more uniform temperature throughout the car body. The heating equipment also includes new types of valves and regulators which are designed to give quicker response, thereby avoiding the usual wide temperature differential.

The coach seats, designed and manufactured at Milwaukee shops, are reversible and reclining with the seat and back integral, similar to a rocking chair. When the back is reclined the seat also rises. The seat-reclining motion is controlled by means of right and left hand nuts, clamping a small pitman rod secured to the seat base. The seat frame is made of 1-in. square tubing bent to shape and welded. A combination of steel springs and rubberized hair is used in the seat cushions and backs in place of sponge rubber.

Interior Finish of the Coaches

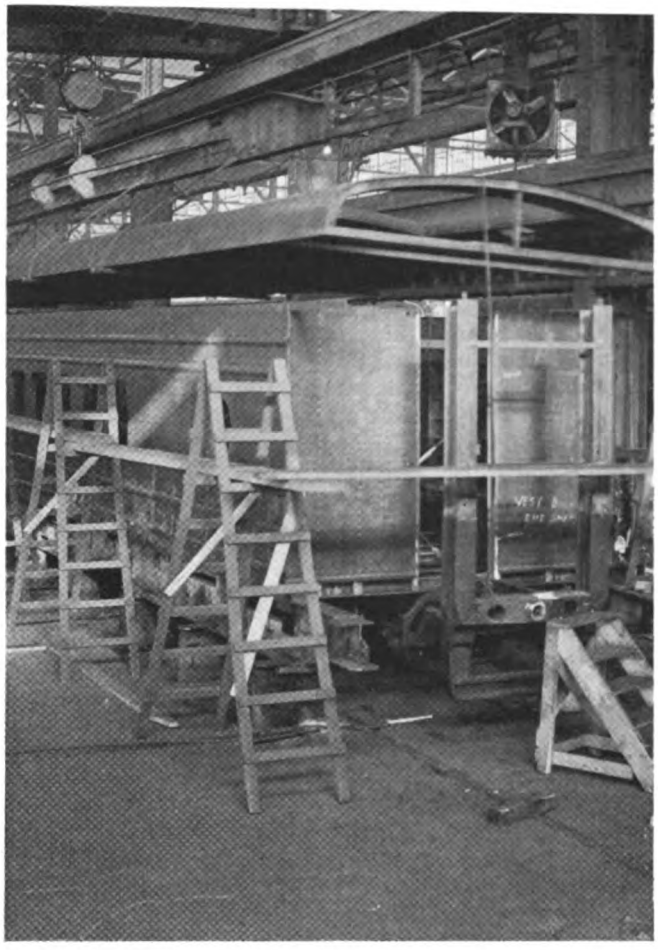
Notwithstanding the difficulty in procuring desirable materials, the interior finish of these cars includes certain definite improvements and innovations. The window construction was an outcome of experience obtained in applying the Pittsburgh Plate Glass Company's hermetically sealed double-glass unit to cabooses built about three years earlier and followed up and tested under adverse climatic conditions. The unit used consists of ¼-in. Duplate safety glass on the outside and ¼-in. Solex plate glass on the inside, separated by an aluminum spacer to provide a 3/16-in. air space between the lights. The edges of the unit are hermetically sealed by means of asphalt tape. The glass unit in turn is mounted in a rubber extrusion and secured to the unique prefabricated window frame, which also carries the window shades or Venetian blinds. A second rubber extrusion is applied directly to the window opening in the car body. A weather tight seal is obtained by suitable pressure between the two extrusions.

The inside finish consists primarily of Robertson bonded metal. Linoleum facing, cemented to the bonded metal, is used under the basket rack where it forms an effective light reflecting surface. The bonded-metal curved ceiling over the basket rack is faced with walnut veneer and extends up to the Pyle-National metal air-



One of the coaches with the fluorescent lights on

duct. Linoleum is also employed at the ends of the car to create the desired color scheme and to give a practical inside finish which can be readily cleaned of finger



Method of applying the roof structure to the body of one of the coaches built at the Milwaukee shops

marks and dirt. In the women's and men's smoking compartment there is a large mirror opposite the door opening.

General car lighting is secured from 110-volt a.c. fluorescent lights, while a 32-volt Mazda shielded night light is installed at each pilaster panel. The lighting was first studied on a full-size section of the car and various conditions and combinations of fixtures tried out until the desired over-all effect was obtained. The fluorescent lights, located immediately above the windows, are separated by the night lights. A plastic shield is used to hide the direct glare of the fluorescent tubes, with the linoleum mentioned above serving as a reflector for the indirect light. The night lights are shielded by small colored-glass star-shaped ornaments.

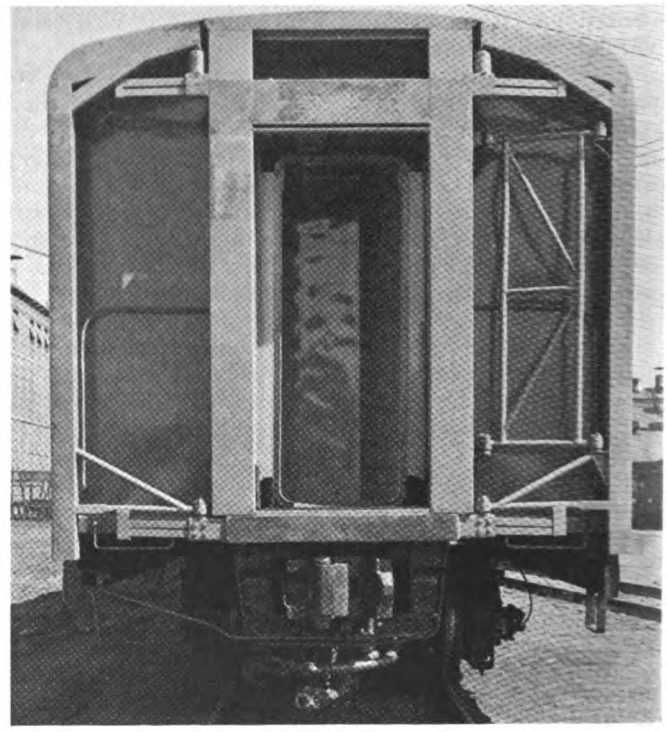
The Auxiliary Dining Car

An entirely new design of auxiliary dining car serves as a practical car for operation next to the dining car. The overflow from the diner is prevented from obstructing service to patrons in the auxiliary dining car, without any appreciable sacrifice in the seating capacity, by means of a full-length corridor and locating the kitchenette in the center of the car, with one waiter serving in each end.

The outstanding ornamental features of the auxiliary diner is the glass-enclosed, illuminated flower box in which plants are placed for decorative purposes. In addition, large ornamental hand-carved wood plaques are located on the side wall of the car, with ornamental mirrors on either side. These wooden plaques represent characters in Longfellow's poem, Hiawatha, and are also applied as wall decoration in the dining cars.

Decorative Treatment of the Dining Cars

The ceiling of each of the dining cars, including No. 113, or Car A and No. 114, or Car B, is divided into three distinct parts. On the steward's end of Car A, the finish of the flat bulkhead underneath the blower is made up of Guana Costa veneer. The center circular air outlets, including the car body panel, are painted a light gray. The side panels of the ceiling to the Pyle-National air-distributing panel is made of zebra wood, vertical grain which includes the coving in the car. On dining Car B, the side panels, coving, and the bulkhead, including the flat ceiling under the blower, are all made of Guana Costa veneer. The flat ceiling at the kitchen end of Car A is zebra wood, vertical grain; on Car B, Guana Costa. All coving and side panels on both cars are made on bonded metal backing. The shield of the fluorescent light trough is made of solid walnut wood with three holly strips inlaid horizontally. The solid walnut trough shield underneath the flat ceiling is re-



End view showing the suspension of the diaphragm and outer enclosure face plates

placed by a translucent glass shield on the side, giving an ornamental effect. The vertical and bulkhead partitions, having gold-tint mirrors mounted in uniformity with the window-sill height, give the dining section the appearance of a larger room. The dining-car chairs, including 32 in each center section and 16 in each end section were also made of steel tubing at Milwaukee shops. They are upholstered in either green or gold plush.

The interior decorative treatment of these cars was developed by Otto Kuhler. The drapes were furnished by L. C. Chase & Company and the upholstery materials by Chase and the Collins & Aikman Corporation.

The Key to Logistics*

By F. K. Mitchell†

Disregard of railroads' need for more cars and locomotives and for adequate manpower and material for repairs risks a military collapse

OUR military leaders have long realized that victorious operations can only be achieved when they are able to have that which is needed in the necessary quantities where and exactly when it is needed. They have recognized the achievement of that end as a science. They have called that science "logistics."

Our transportation leaders have likewise long realized that successful railroad operation requires exactly the same fundamental elements. They have not recognized it as a science, but have unconsciously developed it into one. If called anything, it was "good railroading."

The railroads normally need varying quantities of almost every known raw product, manufactured article, food, clothing, supply, and personnel. As always, in war time, the military forces had need for exactly the same things as did the railroads. Therein lies the complication which makes the procurement of "that which is needed" by the railroads one of the most gigantic undertakings yet faced by them.

The Railroads' Own Logistics Problem

While the revenue ton-miles in 1942 went up 68.8 per cent over 1940 and the revenue passenger-miles went up 123.1 per cent during the same period, the purchases of materials and supplies went up only 40.3 per cent. In October, 1942, the actual ownership of locomotives was three per cent less than in October, 1939. During that same period we had only increased our freight-car ownership 5.6 per cent and the number* of our passenger-carrying cars (exclusive of dining, lounge, mail, baggage and express) had decreased 1.6 per cent. It is quite obvious, then, that our actual procurement of materials and supplies did not increase in proportion to our traffic increase. Shortly after the outbreak of war we estimated that by October, 1942, we should have 974 new locomotives and 113,594 new freight cars. We actually were allowed to install 783 new locomotives, an increase of only 4.8 per cent, and 80,874 new freight cars, an increase of only 1.9 per cent. In this instance again our procurement in nowise paralleled our increased traffic demands.

Equipment Requirements and Prospects in 1943

Type of equipment	Estimated requirements	Authorized	Probable needs above the present authorized
Locomotives:			
Freight	1,399	446*	953
Passenger	583	None	583
Switch	606	306	300
Cars:			
Passenger	2,266	None	2,266
Freight	105,650	20,000	85,650

* Includes 123 5,400-hp. Diesel locomotives, only 36 of which will probably be built in 1943.

The Association of American Railroads began an analysis of the situation with the assistance of other agencies and the railroad officers generally. These studies pointed definitely to certain programs which involved the augmentation of improved procurement methods with substitution, conversion, reclamation, and intensified utilization.

Improved methods of material and supply procurement was primarily a problem handled by the purchases and stores departments. Within their own departments they set up new agencies for the purpose of maintaining closer contact with the needs of other departments and with supplier and regulatory bodies. About the time they had relearned the alphabet and its new letter combinations and knew a priority from a directive, a new material procurement plan was sprung on them. Their chins are still up, however, discouraged though they must be, and with anything like an even break they will not fail where success is at all possible.

Substitution has been the problem of every railroad man. Typical of substitutions not found successful are the use of hot-drawn for cold-drawn tubing in the manufacture of bushings in spring and brake-rigging parts; malleable iron for bronze in certain gate- and globe-valve parts; iron for copper pipe on high-pressure steam lines in locomotive cabs; gun iron for bronze rod bushings on high-speed locomotives, and plain for coated welding rod used in welding alloy steels.

Typical of substitutions which will probably be at least fairly satisfactory for the duration of the war are enameled or painted carbon-steel parts for chromium or nickel-steel parts used in the trimming of passenger cars; carbon steel for alloy steel in the manufacture of locomotive parts, such as rods, motion work and boilers, and car parts such as sheets; friction for roller bearings on locomotives and cars; wood instead of steel for the floors of gondola cars; gun iron for aluminum or bronze crosshead shoes, and perhaps for rod bushings on switching power; silver for zinc solder; linoleum for carpet floor coverings; spring cushions for foam-rubber cushions; gray iron for bronze shoes and wedges, and female for male employees on many lighter types of work.

Notable among the substitutions which will probably be even more satisfactory than the old style materials are Insulmat for wood in cab linings; Satco metal for bronze hub liners on locomotive engine truck, trailer and driving wheels in some classes of service, as well as for lining of journal bearings; malleable for brass washout and arch-tube plugs; steel for bronze in the manufacture of bells, and plastics for critical metals in many parts.

Conversion of plants and equipment has gone on apace. Power plants and locomotives have been converted from

* Abstract of a paper presented before the New England Railroad Club on February 9, 1943.

† Assistant general superintendent of motive power, New York Central.

oil to coal burners, Pullman chair, observation and lounge cars, mail and baggage cars; yes, even box cars have been converted to coaches. Box cars have been converted to cabooses; box cars and cement container cars have been converted to oil-carrying cars; locomotive shops have been converted to handle war work, such as the manufacture of engines for Liberty ships, tank parts, armored car parts, etc., and the labor agreements have been revised or converted to meet the emergency.

Reclamation as a means of reducing the consumption of critical materials has been particularly productive. In the general picture the most spectacular results have been evident in the scrap drive conducted on all railroads as a part of the National Scrap Campaign. As indicative of the results of this drive Class I railroads shipped to dealers and consumers during 1942 nearly 4.5 million net tons, or approximately a million more net tons of scrap than in 1940. Less spectacular, but perhaps of more permanency in the effect on the general situation, is the introduction of new reclamation processes. For example, building up driving- and trailer-wheel centers by the Unionmelt process when below service limits; metal spray reclamation of crank shafts and many other parts; development of welding processes hitherto untried, such as the welding of spring steel for driving, engine-truck, trailer, tender and car semi-elliptical springs, and the tipping of cutting tools where the former practice was to make the entire tool, shank and all, of high-speed steel. The last-mentioned process is noteworthy for its results in that it not only produces just as satisfactory a cutting tool, but makes possible the using of every small piece of tool steel formerly scrapped.

A Record Equipment Utilization

	1940*	1942*	Per cent improvement
Per cent of active freight locomotives to total (October)	70.4	87.8	24.8
Average freight locomotive-miles per month, (total locomotives) (October)	2,249	3,198	41.9
Miles per day per active freight locomotive	107.5	122.5	13.9
Miles per day per active passenger locomotive	190.8	204.5	7.2
Per cent of unserviceable freight cars	5	3	40.0
Freight car-miles per active car per day	42.2	50.6	19.9
Average freight-car load, net tons per car	27.6	31.5	14.1
Average freight-train load, net tons per train	849	1,030	21.3
Net ton-miles per train hour	14,028	16,216	15.6
Passenger occupancy per train	60.7	115	72.0

* Figures for full year 1940 and first ten months of 1942, except as indicated.

These reclamation processes, and many others, have resulted in making tons of critical metals and materials available for the production of war materials.

While on the subject of reclamation, I might say in passing that the railroads, through recalling retired employees to service, lowering physical requirements, and raising the upper age limits for hiring, job instruction training, intensifying safety activity, improving sanitary and working conditions, have reclaimed many manhours which have made a corresponding number of men available to the military services.

Increased Utilization a Great Accomplishment

Our efforts toward greater utilization of such motive power, cars and equipment as we have available to us have produced results never paralleled in history. If anyone has the idea that these things were accomplished without heartbreaks, sweat and, perhaps, tears by every class of railroad employees, his conception of the task is dwarfed by ignorance or indifference. Perhaps the most appreciative groups outside the railroad circles, are the shippers (who by their cooperation had made many of these things possible), the suppliers, and the military authorities. The loyalty, devotion to duty, and quiet patriotism which has helped make the solution of the railroads' own logistics problem thus far possible is a thing that you and I can even now hardly comprehend.

Demands of Military Logistics Growing Fast

There are now in our military forces some five and one-half million men. We are told that this figure is to be increased to at least seven million. Every one of these men must be hauled at least five times before he goes overseas. From the time of his induction into the service until his discharge every pound of food he eats, clothing he wears, equipment and tools he uses, his weapons, ammunition, medical and surgical supplies, both in the stage of raw materials and completed articles, must be transported largely by rail.

It is estimated that in 1942 troop movements and men traveling on military or naval leave resulted in the handling by American railroads of nearly ten million military men in organized groups of fifty or more, also that counting all individual and organized group movements, 15.7 billion passenger miles were produced. Assuming that this movement will increase in proportion to the size of our armed forces, when the seven million figure is reached, we can expect to have to haul 12,700,000 men in organized groups annually and produce for all military and naval travel 19.9 billion passenger-miles annually. In 1942, 15 per cent of all railroad coaches and 40 per cent of all Pullman cars were used continuously for group movement of troops. Since practically no coaches or Pullman cars are being built, unless some adequate relief along these lines is afforded, about one-quarter of all available coaches and half the available Pullman cars will be continually in use by our armed forces when the seven million figure is reached.

The movement of one so-called "triangular" infantry division requires some 65 trains and 1,350 cars. The movement of one armored division requires 75 trains, varying from 28 to 45 cars each. During some months in 1942 as high as 3,000 special trains were moved. When the military personnel reaches seven million men, this special movement may well be expected to reach as high as 3,800 trains in a single month.

Even more enormous is the job which may be expected to fall on the roads, due to the increased demand for handling military supplies and equipment. During 1942, they handled 630 billion ton-miles of freight as against 475 billion for 1941. Not all of this increase was due to military requirements, but it is probable that most of it was. On that basis, approximately 155 billion military ton-miles were produced. Assuming that this load will increase in direct proportion to the increase in men in our military forces, it may be concluded that when their number reaches seven million we will have a military freight load of 195 billion ton-miles annually, 40 billion over the present load.

Abstractly considering these facts, certain probable equipment requirements can be forecast. In 1942, approximately 7,000 passenger locomotives produced 50 billion passenger-miles, or 7.2 million passenger-miles each. An increase of 4.2 billion passenger-miles due to increased military travel would then require 583 additional passenger locomotives. In 1942, 22,000 freight locomotives produced 630 billion ton-miles, or 28.6 million ton-miles each. An increase of 40 billion ton-miles due to increased military requirements would require 1,399 additional freight locomotives. In 1942, 27,756 passenger cars produced 50 billion passenger-miles or 1.8 million passenger-miles each. On this basis, 2,266 additional passenger cars would be needed. In 1942,

1,690,570 freight cars produced 630 billion ton-miles, 378,600 ton-miles each. On this basis, 105,650 additional freight cars would be needed. Assuming that the ratio of switch locomotives required would be the same as the present ratio of switch to freight locomotive ownership, approximately 908 added switch locomotives might be required. Readjusting this estimate on the basis of Diesel switch locomotive performance and assuming that all switch locomotives procured would be of the Diesel-electric type, approximately 606 new locomotives might be needed.

Contrast these estimated needs with the equipment authorized thus far in 1943 (see the table).

It is recognized that many factors will no doubt influence the accuracy of the abstract requirement figures quoted. As overseas supply lines are lengthened and the number of men overseas increases, the quantities of material and supplies lost will increase and the quantities enroute will likewise increase. Greater amounts of fuel oil and naval supplies will be needed for the transportation of these things overseas. These military forces may be increased even beyond seven million, and naval forces may also increase in nearly the same proportion. These and similar, perhaps unforeseen, circumstances may make the estimates low. Reduced civilian requirements, changes in military training and tactical plans, the production of satisfactory synthetic rubber in large quantities, completion of contemplated pipe lines, and similar circumstances may make the estimates high. We must, however, plan for the future in such a way that, regardless of what happens, our equipment needs will be adequate. Only by so doing can our part of the military logistics job be met successfully.

The Railroads Face Five Handicaps

What are we faced with in fulfilling our obligation to get these military supplies and materials delivered to the point where needed in the quantities needed, at the time they are needed?

First—An acute manpower shortage, growing even more so. In 1940 we had on the Class I roads, 1,026,848 employees and in 1942 had increased that by 22½ per cent to 1,270,000, while the freight load went up 68.8 per cent and the passenger load went up 123.1 per cent. We have lost between 8 per cent and 10 per cent of our forces to the military services and between 22 per cent and 25 per cent to other industry in addition to our normal losses through mortality, retirement, etc. Many wise and productive schemes have been set in motion to aid in keeping our manpower up to the requirements. Yet even now there are an estimated 60,000 positions vacant. We will work out our own salvation as far as it is humanly possible, but must have the support of the selective service boards and the Manpower Commission.

Second—A continued and even more difficult job of material procurement for our own ever increasing needs. In this situation we realize the problem with which the various governmental agencies are faced, but also that while some officials of those groups are sympathetic to our necessities, others are not. They do not yet realize that we must have material when it is needed, that if we wait for a locomotive to be out of service before a directive or an emergency priority is given, and the return of that locomotive to service is delayed just one day, 78,383 tons of war materials will be just one mile farther from the place where it is needed.

Third—An actual equipment shortage that is not being corrected as rapidly as we feel circumstances demand. Here again, governmental agencies charged with the responsibility of new equipment procurement and allocation could help more if its officials were unanimous in their opinion that our needs are actually a part of, and not secondary to those of the military and naval forces. There is probably only one governmental agency or department that really has that conception of the picture.

Fourth—Deferred maintenance becoming necessary due to lack of manpower and material, plus our inability to hold equipment out of service long enough to make essential repairs. Every railroad man knows when that snake in the grass issues its warning hiss there is trouble ahead. We have already heard the warning. It must be killed before it can raise its head to strike.

Fifth—An apathy on the part of the general public, not conducive of forcing their political leaders to recognize that the railroads are the Number One key industry in the war effort. Perhaps we are, as much as anyone, responsible for this; we have heretofore done a poor job of selling ourselves to them. We must overcome this failure; that is your job and mine.

The time has come when the railroads must be accepted as and accorded the action necessary to support them as the Number One key war industry. Unless that acceptance and accord are forthcoming future generations will wonder why this one was so shortsighted as to cripple the life line of transportation in a time as critical as this!

Are We Copying Germany's Mistakes?

Of what avail to MacArthur, Montgomery and Eisenhower, Timoshenko, or Nimitz are a million men that they cannot get when and where they need them; a million tons of ore at the mines, when it is needed in tank steel; a hundred thousand tanks in Detroit when they need them to start or support an offensive; a million barrels of oil in Texas when it is needed in the holds of their ships, or ten thousand airplanes on the front line and the gasoline for them in tank cars somewhere in these United States waiting for locomotives to move them?

A wall paper hanger by the name of Schikelgruber conceived the idea, in his paste-filled mind, that such things could be prevented by employing other means than his railroads. His own railroad people plead with him to allow them to put his railroads in shape to do the job. I know that to be a fact, for when he finally was coerced into doing something about it he sent a committee over here to study our railroads and their methods preparatory to instituting a rehabilitation program. Those men spent some time on the railroad for which I was working and I drew the job of accompanying them. I still have their business cards. They would have done the job, and done it right, but by the time they were ready, war had already broken out and they were denied the materials and equipment with which to do it. Today in Germany the railroad situation is desperate. Schikelgruber is frantically appropriating the equipment from conquered countries, trying to patch it up and again restore the transportation element of his logistics problem to its normal adequate functioning through railroad transportation.

In England the situation on the railroads is none too healthy. This is not because of any shortsighted policy or delusion that their railroads were not a definite factor in the British logistics problem. Destruction of roadway, structures and equipment through bombing, in addition to the added war load, is proving more than they can handle. We are helping straighten out that situation by furnishing men, facilities and equipment. You have had it revealed to you through pictures of American built locomotives being unloaded in England.

As the link is to the chain, as the hub is to the wheel, as the engine is to your automobile, as the machine tool is to production, so the railroads are to military logistics. If they function adequately, logistics will continue to be a science, if not, it will deteriorate into a chaotic muddle.

Nickel in Railroad Service*

By B. B. Morton†

BEFORE dwelling upon the effects of nickel in railroad equipment, I would like to point out the remarkable versatility of nickel as an alloying element. It has been said that nickel alloys with nearly all industrially used elements with benefit to the existing alloy or element.

In ferrous metals nickel is invoked to harden and also to soften. For instance, consider Ni-Hard cast iron, one of the hardest of irons and Ni-Containing grey cast iron, soft and machineable; it affects the coefficient of thermal expansion and is used to decrease and also to increase it. In this connection, it may be pointed out that nickel-containing alloys are made with practically zero coefficient of thermal expansion at room temperature and other alloys are formed that will match the coefficient of expansion of aluminum. Jigs of this latter alloy are admirable for use with aluminum. The magnetic characteristics of materials are affected by nickel. On one hand we have the strongly non-magnetic alloy K-Monel which is used in directional drilling of oil wells and for many other uses and on the other hand we have the Alnico type of permanent magnets that are famous for their magnetic properties. The corrosion resistance and heat resistance of the high chromium alloys are enhanced by nickel additions. In fact, the most corrosion resistant of the alloys such as the Hastelloys, LeBour metals and others contain large percentages of nickel. The remarkable alloys of monel (nickel-copper) group indicate the possibilities of the combinations in which nickel predominates. Brass in which nickel has replaced zinc to form the 70/30 copper nickel alloy has contributed tremendously to the war effort as condenser tubes, fire lines of ships, etc. One of the spectacular uses of nickel is to protect the impact property of steel at low temperature and an outstanding example is the storage spheres for methane in liquid form at —260 deg. F. The inner low temperature spheres are of 3½ per cent nickel steel.

Nickel slows up the rate of transformation of steel and ferrous alloys, thereby providing a desirable latitude in heat treating operations. With large percentages of nickel or in combination with chromium transformation is so retarded that the steel may remain austenitic (as evinced by low order of magnetism). As examples of austenitic steels the 18 per cent chromium—8 per cent nickel alloys and the steels containing 32 per cent or more of nickel are cited.

Nickel exerts a profound influence upon the mechanical properties of cast irons. Up to about 3 per cent additions of nickel are used to prevent chill spots and to precipitate graphite. These irons are used where free machining is desired in combination with good strength. By special manipulation these low alloyed irons can be given very high strength up to 80,000 lb. per sq. in. The Ni-Tensyl group of high strength irons, often under various trade names, have made a good reputation for themselves. With further increases of nickel 4 to 7 per cent and with the addition of chromium, irons of great hardness are produced and find use to resist abrasion. Such irons find application especially in mining and dredging operations. With additions of 15 per cent to 35 per cent with and without other elements the non-magnetic, austenitic irons are formed and are widely used to resist various forms of corrosion as from sea water, caustic, sulphuric acid, etc. The austenitic irons also possess a high degree of heat resistance. By varying the nickel content the coefficient of thermal expansion of the austenitic irons can be controlled within certain limits.

Table I—Typical Properties of Hot-Rolled 2 Per Cent Nickel Boiler Steels

(Shell plates)

C	Mn	P	S	Si	Ni	Yield Point, lb. per sq. in.	Tensile Strength, lb. per sq. in.	Elong. in 8 in. per cent	Red. area, per cent	Izod impact, ft.-lb.	Remarks
0.19	0.67	.018	.024	0.21	2.16	54,800	77,600	28.2	55.3	....	¾ in. plate; (transverse specimens)
0.18	0.59	.020	.022	....	2.25	46,600	77,000	28.0	61.0	65	1 in. plate; (longitudinal specimens)

Effect of Nickel on Steel and Iron

In steel, nickel enters into solid solution with the ferrite and tends to strengthen this component. It does not form a carbide, as do many other alloying elements. This is considered a distinct advantage, since it permits the use of low carbon steels where high strength, toughness and weldability are desired. An important characteristic of nickel steels is that for a given value of ductility as measured by elongaiton the strength will exceed that of carbon steels. In general the ductility of nickel steels at high strength is outstanding.

Fatigue Failure

Service on the railroads is severe and steels of unusual toughness are desired. Failures of running equipment can in 90 per cent of the cases be ascribed to fatigue failures (often referred to as crystallization by the practicing mechanic).

While it may appear presumptuous here to outline conditions of fatigue failure, especially in view of the excellent dissertations on the subject presented by Fred Williams, test engineer, Canadian National, and others, a brief summary will be offered in order to throw some light on the subsequent discussion.

* Abstract of a paper presented before the Canadian Railway Club, Montreal, Que., March 8, 1943.

† International Nickel Company.

In general, fatigue failure occurs when a repeated stress of an intensity greater than the endurance limit acts upon a part over a period of time. The main controlling factor is the intensity of the stress, since this value controls the number of reversals necessary to produce failure and hence the time for failure to occur.

Dealing with laboratory specimens highly polished and gently handled, one obtains a value for an endurance limit and this value is close to one-half the ultimate strength. It is further noted that stresses below the value of the endurance limit fail to produce rupture over a long period of time and a very large number of reversals. In practice, the endurance limit is not a sharply determined stress value but varies downward with size of section and chiefly with the condition of the surface. The condition of the surface is considered to intensify the stress, or to lower the endurance value as obtained for the same material from polished specimens. So marked is the variation in practice from the polished specimens that few people consider the piece in service to have definite or at best a determinable endurance limit and good practice appears to be to expose the part in service to frequent tests by Magnaflux or other means for determining the presence of incipient or developed cracks. It is known, and Mr. Williams has especially brought out, that scratches, punch marks or any irregular distortion of the surface will result in premature failure by parts in fatigue. Sharp changes in direction and press fits contribute to failure. Hardening, i. e. strengthening, of the surface offers one of the best means towards elimination of fatigue failures. Even means of hardening offer some dangers and one should consider the work by Dr. Horger[2*] and others before attempting to treat a part, especially by flame hardening.

Nickel in Locomotive Boilers

Locomotive boilers are usually designed by applying a factor to the ultimate strength of the steel used. It follows then that weight reduction is dependent upon the ultimate strength of the plate. Other requirements besides strength are required, since a good degree of ductility, as measured by elongation, is considered necessary and general excellence of the plate is desired. So enormous is the energy stored in a locomotive boiler and so potential is the destructive power that great care in specifying and choosing a steel for such a boiler is justified.

Nickel steels due to their mechanical properties which embrace high impact values in the as-rolled plate have been widely used as the material for locomotive boilers. Table I. An outstanding performance of nickel steel boilers has been on the Canadian Pacific. The author has not been able to date to discover the reason for the good performance of the boilers of the Canadian Pacific as compared with boilers of the same material of roads in the States. The reasons may be many and are undoubtedly complex but the excellent preparation and construction of the boilers must play an important part.

Table II—Typical Properties of Normalized Low-Carbon Nickel-Steel Forgings*

(Normalized around 1475 deg. F., drawn 1050-1200 deg. F., Brinell hardness 170 to 180)

Composition, per cent						Yield point, lbs. per sq. in.	Tensile strength, lbs. per sq. in.	Elong. in 2 in. per cent	Red. area, per cent	Approx. size, in.
C	Mn	P	S	Si	Ni					
0.24	0.99	.018	.023	0.23	2.65	61,200	86,200	29.0	63.3	Main pin 10 in. dia.
0.24	0.81	.021	.024	0.23	2.65	60,400	84,200	30.5	60.4	Main axle 11 in. dia., 3¼ in. hole
0.25	0.84	.020	.022	0.25	2.65	64,900	85,400	33.0	69.5	Main rod 7 in. x 9 in.
0.24	0.78	.016	.021	0.18	2.60	61,700	85,200	31.0	66.6	Piston rod 7 in. dia.

*Izod impact values obtained were between 70 and 80 ft.-lb. At comparable tensile strengths normalized and drawn plain carbon steel with 0.50 per cent carbon has an Izod value around 15 to 25 ft. lb. with a yield point of only about 45,000 lb. per sq. in. Properties on tests taken at mid-section.

Typical Properties Taken from Mid-Section of Forgings, Oil Quenched from 1,475 deg. F. and drawn at 1,200-1,250 deg. F.

Part	Yield point, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elong. in 2 in., per cent	Red area, per cent
Piston rod—6½ in. diam.	75,900	104,800	25.0	47.1
Driving axles—10½ diam.	73,800	93,200	30.0	62.3
Crank pin—10½ in. diam.	75,500	96,000	29.0	59.0

The rotating beam fatigue limit on specimens cut from the mid-point of forgings of this type is around 57,000 lb. per sq. in.

The whole explanation cannot reside in the construction, since the engineers of the Canadian Pacific have been most generous with their information so that comparable construction can probably be found. Other factors must be sought to explain the difference in performances. It is quite possible that length of boilers and operating factors account for the differences in operation noted.

In general it would appear that boiler failures occur from at least three main sources, namely low water; caustic embrittlement and fatigue failures.

Low water is considered the chief source of boiler failures that reach catastrophic proportions.

Caustic embrittlement is a center of acrimonious discussion. Failure of parts is often attributed to this source. The excellent work of Dr. Schroeder, Bureau of Mines and Dr. Straub, chemical engineering department University of Illinois, has done much to enlighten the public on the subject of caustic attack and to alleviate its consequences. Caustic embrittlement appears to be dependent upon three principal factors; a joint that leaks just enough to allow concentration of caustic salts; a heavy stress in the metal and the absence of inhibitors as the nitrates; tanning extracts, etc., which have been found effective as preventors of this type of embrittle-

Table III—Cast-Low-Carbon 2 Per Cent Nickel Steel

(Representative properties on test coupons treated with the castings)

Type treatment: 1700 deg. to 1850 deg. F., air cooled; 1500 deg. to 1550 deg. F., air cooled; drawn 1000 deg. to 1200 deg. F.

Composition, per cent			Yield point, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elong. in 2 in., per cent	Red. area, per cent	Izod impact, ft.-lb.
C	Mn	Ni					
0.18	0.93	2.20	53,300	84,000	30.0	61.0	59
0.18	0.85	2.26	51,500	81,000	29.0	55.5	62
0.19	0.81	2.20	50,000	80,500	28.0	59.0	56
0.17	0.82	2.18	50,800	80,200	30.5	62.5	64
0.17	0.84	2.10	51,000	79,000	32.5	62.5	55

* Tab. and subsequent numbers indicate reference to bibliography, page 169.

ment. Other factors, as types of salts, appear also to bear upon this form of attack.

Experience seems to indicate that no steel is immune to caustic embrittlement under conditions favorable to such attack. The use of inhibitors promises some relief but each condition favorable to embrittlement has to be studied as a separate case and often a specific inhibitor must be developed.

Removal of the type of joint conducive to caustic embrittlement appears to be the most logical approach to the problem of eliminating this type of failure. The welded boiler, stress relieved and X-rayed, would appear to be the most promising solution to the problem. Nickel steels such as used for riveted boilers[3] offer themselves as the ideal material for welded boilers. The petroleum industry has made generous use of welded vessels of low carbon, 2 to 3 per cent nickel steels especially for use at sub-zero temperatures. The vessels so fabricated have given excellent service to date. It is recognized that the element of fatigue is more prevalent in the locomotive boiler than in the vessels of a refinery, hence fatigue data are more important.

Certain tests of welded 0.19 per cent carbon, 2.38 per cent nickel steel plate welded with a rod developing 0.08 carbon and 1.89 per cent nickel in the weld are under way to throw light upon the usefulness of the 2 to 3 per cent nickel steels for locomotive boilers. Endurance limit of weld metal and metal adjacent to the weld will be made. The plate shows 70,000 to 75,000 lb. per sq. in. ultimate, and the weld 75,000 lb. per sq. in. ultimate strength. The elongation in plate and weld is 27 per cent and 24 per cent respectively. All bend tests have been readily met. The results of the tests, including the endurance limits will be published when completed.

Some evidence of failure of boiler parts in pure fatigue has come to attention. Very long boilers must be considered as ideal fatigue subjects and must be guarded by reducing the tendency of the track forces to treat the boiler as a cantilever beam. Failure of this type will usually be noted in the girth beam in the throat section. Wear plates and other parts are subject to reversals of stresses and hence to fatigue failure. Vibration is a fruitful source of rapidly reversed or varying stresses that can bring on fatigue failure of parts from which vibration are not dampened or which, like springs, have not been designed specifically to withstand such stresses. Failure of springs indicate the potency of varying stresses to produce failure.

Firebox Sheets; Staybolts

The firebox of a locomotive undergoes grueling service. The sheets of the firebox expand due to the temperature involved in driving heat into the water. Expansion is restricted by the restraining action of the ends and by the staybolts. The stresses due to thermal expansion are so great that distortion of the firebox sheets often occurs at an early stage of their life.

Two per cent nickel steels 0.17 carbon (max.)[8] have been widely used for side sheets and crown sheets. The results obtained are erratic and depend, as might be expected, upon operating conditions.

Failure chiefly occurs on the fire side and appears to be from a fatigue action. This action can result from fluctuations of heat input and especially when violent change occurs as when pulling a grade with an oil burning locomotive and then drifting on the reverse side with little heat input to the box.

A complex form of failure has been recognized by the Research Laboratory of the International Nickel Company. This involves the inclusion in the crack of products of corrosion which act in a wedging manner to propagate the crack. Considerable data exists to substantiate this theory.

Ray McBrian, engineer of standards and research, D. & R. G. W., lays great emphasis upon the decarburized surface of the plate as providing nuclei for fatigue cracks. His views are impressive and find much in the theory of fatigue to support them.

Undoubtedly any steel can be induced to fail in a fire box. It requires patient and time consuming study to alter firing conditions to prevent failures. When such studies are made they amply reward the road. Often one item of draft control or burner manipulation will provide a longer life for side sheets.

Staybolts appear to be a necessary feature of engine construction. Decades of study have failed to find a good substitute for these pieces of equipment. Evolution of materials have led to the widespread use of nickel irons and steels[9] in a large number of installations.

Locomotive Parts

The 2¾ per cent nickel steels[4] have been widely used as forged and heat treated side rods (Table II). The record of performance has been good. This material also finds use as the highly stressed main pin, also for piston rods, driving axles and many other uses.

Table IV—Cast Low-Carbon Nickel-Vanadium Steel

(Representative properties on test coupons treated with castings)

Type treatment: 1700 deg. to 1850 deg. F., air cooled; 1500 deg. to 1550 deg. F., air cooled; drawn 900 deg. to 1200 deg. F.

Composition, per cent				Yield point,	Tensile strength,	Elong. in	Red area,
C	Mn	Ni	V	lb. per sq. in.	lb. per sq. in.	2 in, per cent	per cent
0.18	0.62	1.44	0.09	58,500	78,500	26.0	47
0.19	0.64	1.62	0.10	57,000	83,500	27.0	52
0.20	0.73	1.60	0.08	64,000	84,000	30.0	63
0.23	0.60	1.54	0.11	60,000	81,000	29.0	54
0.25	0.62	1.45	0.10	61,000	80,000	28.5	55

Table V—Cast Medium Carbon Nickel-Vanadium Steel

(Representative properties on test coupons treated with castings)

Type treatment: 1700 deg. to 1850 deg. F., air cooled; 1500 deg. to 1550 deg. F., air cooled; drawn 900 deg. to 1200 deg. F.

Composition, per cent				Yield point,	Tensile strength,	Elong. in	Red. area,	Izod impact
C	Mn	Ni	V	lb. per sq. in.	lb. per sq. in.	2 in., per cent	per cent	ft.-lb.
0.30	0.81	1.52	0.11	66,200	96,000	27.5	55.0	56
0.28	0.89	1.66	0.10	65,400	95,000	28.5	57.5	60
0.26	0.97	1.54	0.11	60,500	90,000	25.5	51.0	47
0.28	0.91	1.62	0.12	64,000	94,000	27.0	55.0	57
0.32	0.97	1.60	0.11	70,500	96,800	28.0	60.0	59

A nickel-chromium-molybdenum steel containing approximately 0.35/0.40 carbon; 1.5/1.75 per cent nickel; 0.65/0.75 chromium; 0.20/0.30 molybdenum was being increasingly used for side and main rods; also piston rods, before present restrictions on the use of alloys.

The desire of some roads for a higher strength side rod material than obtained from the 2¾ per cent nickel steel that would not require a quenching operation led to the use of a 0.25-0.35 carbon; 2.50-3.00 nickel; 0.20 to 0.40 molybdenum steel[5]. This steel apparently has amply proved its worth.

The low-carbon nickel steel casting possesses a desirable degree of ductility and toughness combined with high order of strength. These features have dictated the use of this alloy for frames and other parts. When properly heat treated, the 0.20 carbon, 2 to 2½ per cent nickel steel castings possess excellent impact values at sub-zero temperatures. This feature has encouraged the use of this nickel alloy for truck of Diesels and some types of cars.

Nickel-vanadium steel castings also have been quite popular (Tables III; IV; V). This alloy contains about 1½ per cent nickel with 0.10 per cent vanadium. The carbon maximum is set at about 0.30 per cent. The low carbon of this alloy and of the 2 to 2½ per cent nickel cast steel renders them readily weldable, which will prove of increasing importance.

Diesel locomotives that are appearing in increasing number on railroads today and even under present restrictions make use of many nickel steels. These steels form such parts as crank shafts, connecting rods, camshafts, valves and highly stressed bolts.

Nickel in Car Construction

For passenger cars the 1.40 nickel, 1.40 manganese cast steels have proven most popular (Table VI). This alloy with 0.30 carbon has good impact and other mechanical properties. The use of 17 per cent chromium, 7 per cent nickel alloys in the construction of cars lead to lighter weight and sturdier construction than otherwise obtainable. The gleaming beauty of this alloy enhances the appearance of the equipment. Following the war there will be a widespread use of this stainless alloy, it is predicted.

Corrosion is a factor in the life of coal cars and tests with low alloy nickel steels and nickel-copper high strength steels are pointing a way to longer life from the conventional car. Use of these weldable alloys also indicates means of lightening the weight of freight cars in general. Nickel increases the tolerances of copper in steel and reduced hot shortness. Corrosion resistance and mechanical properties of the copper steels are enhanced by the presence of the nickel.

Nickel Cast Iron; Monel

Nickel containing cast irons have long played an important part in the make up of locomotives (Table VII). They will be found in such parts as cylinders, cylinder liners, pistons, rings and grate bars. The development of the Canadian Pacific with grate bars has been an important contribution to railroading. It is hoped the very hard Ni-Hard cast iron will make a contribution to resistance to cinder cutting. Tests are under way.

The 69 per cent nickel, 29 per cent copper alloys with the variations in composition that make up the various grades of Monel have been widely used in the railroad fields.

Monel pump rods have long been known in locomotive circles and the results to date justify the choice of this material.

Before the war, the abrasion resistance of Monel had led to its use as shrouds under some streamlined cars. This application will undoubtedly have wider scope in the post war era.

Monel staybolts have made an excellent showing in some of the locomotives of England and the continent. Tests of Monel bolts are under way on a prominent railroad of the eastern part of the States.

In washrooms and galleys Monel and the nickel containing stainless steels share honors in maintaining pleasing appearances and sanitary conditions.

Conclusion

The foregoing has been an attempt to depict some important uses of nickel containing alloys on railroads. The forward strides expected from the railroads of the post war era will undoubtedly make heavier demands upon these alloys that have already contributed so much to the present advance.

Table VI—Cast Nickel-Manganese Steel

(Representative properties on test coupons treated with castings)

Type treatment: 1500 deg. to 1550 deg. F. air cooled; drawn 950 deg. to 1200 deg. F.

Compositions, per cent			Yield point,	Tensile strength,	Elong. in	Red. area,	Izod impact,
C	Mn	Ni	lb. per sq. in.	lb. per sq. in.	2 in. per cent	per cent	ft.-lb.
.27	1.48	1.43	62,800	91,400	28.5	63.5	45
.31	1.60	1.41	68,400	101,700	26.5	59.5	65
.28	1.62	1.43	69,800	96,500	27.0	57.0	63
.28	1.44	1.57	65,400	94,500	28.0	55.0	
.27	1.41	1.40	61,000	99,200.	24.5	57.5	41

Table VII—Applications of Alloy Cast Iron in Locomotives

Application	Typical compositions used, per cent				
	Total carbon	Silicon	Manganese	Nickel	Chromium
Cylinders	3.10	1.10	0.90	1.10	0.40 Max.
Cylinder bushings, piston bull rings, packing rings, piston valve rings and followers	3.10	1.50	0.70	1.20	0.40 Max.
Slide valve bodies and bushings	3.20	1.50	0.70	1.10	..
Crosshead gibs, grinders, blocks and shoes	3.20	1.30	0.80	1.00	0.30
Grate bars	3.20	1.20	0.80	1.50	0.60

Bibliography

1.—Alloy Steels in Boilers, by A. B. Trumbull, chief mechanical engineer, Mechanical Advisory Committee, C. & O., *Railway Mechanical Engineer*, Feb., 1943.

2.—Testing Locomotive Axles, by Dr. O. J. Horger, research engineer, Timken Roller Bearing Co., *Railway Mechanical Engineer*, October, 1938.

3.—Recom. R.R. Spec. No. 3, latest Rev., The International Nickel Co., 67 Wall Street, N. Y. C.

4.—Recom. R.R. Spec. No 2, latest Rev., The International Nickel Co., 67 Wall Street, N. Y. C. Also A.A.R. Spec. M-104-(c).

5.—Recom. R.R. Spec. No. 13, latest Rev., The International Nickel Co., 67 Wall Street, N. Y. C.

6.—Recom. R.R. Spec. No. 8, latest Rev., The International Nickel Co., 67 Wall Street, N. Y. C. Covers "Low Carbon Nickel Steel Main Frames for Locomotives."

7.—Recom. R.R. Spec. No. 4, latest Rev., The International Nickel Co., 67 Wall Street, N. Y. C. Covers "Low Carbon Steel Casting for Locomotives and Cars."

8.—Recom. R.R. Spec. No. 3, latest Rev., The International Nickel Co., 67 Wall Street, N. Y. C.

9.—Recom. R.R. Spec. No. 7, latest Rev., The International Nickel Co., 67 Wall Street, N. Y. C.

ROUNDTABLE on



Posters used in the locomotive department of the repair shops of the Southern Pacific Company at Sacramento, Calif.—The same practice is followed in the passenger and freight car departments

In the March issue our readers were invited to join in a roundtable discussion of the problem of absenteeism. "How can we reduce absenteeism to a very minimum?" What practical suggestions have you to offer?" we asked. The comments received which appear on this and the adjoining page cover a lot of ground and contain many useful suggestions. See page 172 for the announcement of the subject of next month's discussion.—EDITOR.

Emphasize Safety

Safety should be emphasized. Rules and practices have been inaugurated and the importance of living up to these rules should be stressed to each employee, in order to prevent accidents and a resultant loss of time, which are costly to the company and retard the war effort. Good housekeeping—properly ventilated and heated shops—promotes safety and better health, which results in a reduction in absenteeism.—*R. V. Blocker, Superintendent Motive Power, Erie.*

Victory Committee Uses Posters Effectively

Everyone is absenteeism-conscious these days and the Southern Pacific Company, like many other railroads and industries, is trying to find a workable plan to minimize this waste of man-power.

It is evident that the old adage, "You can lead a horse to water, but you cannot make him drink," applies here. Barring compulsion laws, our plan must find in some way an incentive to make men and women want to work. Paradoxically, the war does not seem to produce that incentive.

Leaving discipline—which is used only in exceptional cases—out of the picture, we have resorted principally to the poster plan, with slogans covering every conceivable inspiring, encouraging, and shaming subtlety of words and pictures our ingenuity could produce, to stimulate this "want to work urge."

This poster plan was inspired and is supervised by a Victory Committee representing both labor and management. The most effective of the posters were ones showing actual losses in reduced output of locomotives, passenger cars and freight cars. The photographs clearly indicate this type of poster. The number of lost man-hours is indicated each month, together with the equivalent in units of production. A removable tag is made for each item, changed each month, to facilitate current posting.

At Sacramento general shops, our largest, for example, three of these posters are used for locomotive, passenger car and freight car shops, one at the respective "check-in" stations and the other two at points in shops where they can be readily viewed. The results obtained since the month of December, 1942, when this type of poster was adopted, is reflected in the table.—*A. B. Wilson, Superintendent Motive Power, Southern Pacific, Sacramento, Calif.*

Importance of Supervision

Some of the main reasons for absenteeism on our railroad at the present time are: Public health, Lack of proper housing facilities, Inadequate transportation, Excessive overtime due to manpower shortage, Mental and physical tension as a result of war conditions, Lack of prompt medical attention and first aid treatment.

Intelligent, sympathetic, understanding supervision is still the largest single factor in reducing absenteeism to a very minimum. Supervision has, of course, little or no control over the first three items mentioned, but can do much in connection with the last three.

In many cases overtime can be more evenly distributed among employees. Supervisors can demonstrate their leadership by more intelligent planning and scheduling of work; by adopting a sympathetic attitude toward the problems of the men under their supervision; by appealing to the patriotic spirit of every employee under their jurisdiction; by doing their utmost to keep calm and cool; and by executing their duties in an orderly manner.—*H. J. Schuthess, Chief of Personnel, Denver & Rio Grande Western.*

Use Safety Campaign Methods

The majority of the employees of the railroads have someone who is very close to them in the armed services, be it brother, son, daughter or others. I believe the seriousness of the safety of those close to us in the armed services—in relation to lost man-hours—can best be emphasized through the use of the safety organizations of the railroads or by similar methods. Posters, bulletins and pep talks, such as used in safety first, should be used. Establish a competitive spirit among the different departments of each road and between all of the railroads, as is the safety first movement.—*C. L. Lehnis, Enginehouse Foreman, Chesapeake & Ohio, Handley, W. Va.*

Bulletin Posted at Sacramento Shops of the Southern Pacific

		No. man-hours lost acct. absenteeism			Equivalent unit loss in output		
	Number men emp.	Loco. dept.	Pass. car	Freight car	Loco. dept.	Pass. car	Freight car
Dec., 1942	3473	57730	4580	9340	7.69	3.67	51.8[illegible]
Jan., 1943	3451	37800	3080	7520	5.04	2.47	40.67

ABSENTEEISM

Appeal to the Emotions

I have thought this question over for some time and believe that for the time being, at least, one should appeal to the emotions of employees—that is to say, impress upon them that they are serving the enemies of the country when they unnecessarily lay off from work.

A certain coal mine operator attempted to solve this problem by erecting a cardboard replica of Hitler giving the Nazi salute with one hand, and extending the other hand in greeting. When any one of the employees absented himself from work without sufficient cause, he was obliged, when he returned to work, to procure his registration and time card for that day from a hook, suitably attached to Mr. Hitler's outstretched hand.

This may not be a very good suggestion to offer, so far as railroad men are concerned, although it did, according to the rumor, serve as a remedy for absenteeism among the coal miners in this particular case. However, my suggestion is that some approach of that kind might be more successful in solving the problem than resorting to the usual method of applying penalties to absentees.—*K. Berg, Superintendent Motive Power, Pittsburgh & Lake Erie.*

A Bonus for Perfect Attendance?

It seems as though some kind of a "bonus" for a perfect attendance record would turn the trick. You may remember that when we went to school some teachers were keen on a perfect attendance showing and would bulletin the record on the blackboard in an effort to keep it on the minds of the students. At the end of the month teacher would, if we had a perfect record, give us some reward—possibly a treat or a couple of hours of rest while she read a thrilling story. Everybody tried to keep the laggard in line so the record would not suffer. How about a cup of coffee and a sinker about three p.m.? It would renew the energy and would keep a man on his feet until he reached home. Some men have to ride for two hours before they can put their feet under the table.—*From a Western Railroader.*

Dramatize by Posters and Publicity

Consideration of absenteeism and its effect on the war effort leads me to believe that some publicity and special study of this subject are imperative. Two types of publicity suggest themselves:

First, the use of bulletins or posters at shops and terminals. In this connection I think it would be well to consider the most effective type of poster, the experience of those who have resorted to this practice, the reaction of the men to the posters, and the possibility of intensifying interest by soliciting poster designs from amateur artists, who are found in a great many railroad organizations.

The second type of publicity which suggests itself is that relating to or equating the man-hour day to the war effort. In other words, how many tons of freight or war materials would be just a mile farther from its destination due to the absenteeism from work of a man for one day in this critical emergency? What the total daily man-days lost through absenteeism on the Class I roads would mean in delays to military supplies—and other such pertinent equations, which would tend to emphasize to the country in general the seriousness of the absenteeism problem.—*F. K. Mitchell, Assistant General Superintendent Motive Power and Rolling Stock, New York Central System.*

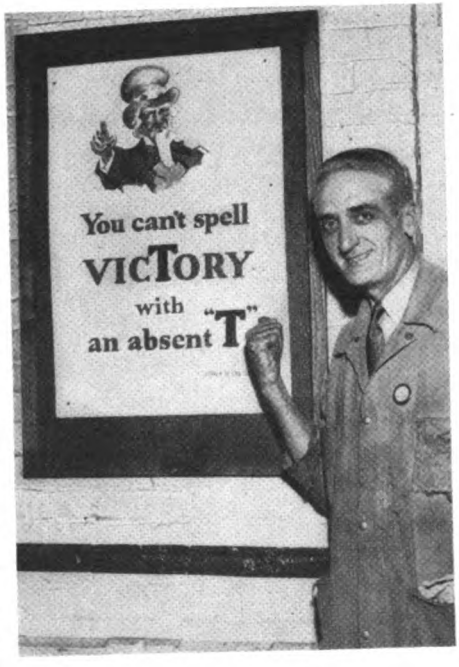
Several Worthwhile Suggestions

We have constantly kept the seriousness of absenteeism before our employees with strikingly appropriate posters, conveniently located in all shops, so they will be observed by the greatest number of employees frequently. We have had the hearty cooperation of our shop crafts committees in keeping the matter before our men; and our supervision has also talked to our men in groups, especially when safety meetings are held, discussing absenteeism as well as increased output. We believe we have obtained a reasonable response to our appeals.

We have recently arranged to handle cases of absenteeism individually where the habitual time-loser is concerned. At times they are interviewed by both the ranking mechanical officer at the terminal, as well as the chairman of the local committee; in this way we only talk to the men actually involved in losing time.

It might be well to give more publicity to the individual who has worked regularly, including Sundays, and possibly overtime. This might arouse the interest of the fellow who is losing time unnecessarily.—*Mechanical Department Officer.*

* * *



John F. Noon, precision grinder set-up man and winner of a weekly slogan contest of employees of the Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

How to Reduce to a Minimum

My suggestions as to how absenteeism can be reduced to a very minimum are as follows:

1—Appeal to the patriotism of each individual.

2—Avoid Sunday work as far as practical, or confine the work to six days per week.

3—The most effective means will be when our wounded boys return from the battle fronts by trainloads. The men will then realize the seriousness of this war and will be anxious to do their part.—*K. F. Nystrom, Mechanical Assistant to Chief Operating Officer, C. M. St. P. & P.*

"We've Got to Lick the Enemy"

The average worker does not see that his absence for a day now and then can really amount to anything. The war has not yet hit close enough home. Nor does he recognize the cumulative effects of many men remaining away from work. The average man needs an incentive to cause him to put forth extra effort. How are we going to produce this incentive? Some industrial concerns have gone so far as to enclose with every pay check a slip stating, "You lost —— days from work this pay. Every day lost is a contribution to the Axis."

We would like to offer the suggestion that management take labor into its confidence more, make the workmen feel they are participating in a real and important job. Pep talks may be hooted at by some, but they are a very real stimulus when properly used.

Men take pride in what they are doing if they are made to feel that their jobs are important. Can't we appeal to the spirit and courage that is in every man, can't we make him see that his job is vital, no matter how lowly?

Men will work if they have an incentive. The incentive is present, but it hasn't been brought home to the rank-and-file. In addition to its other duties, it is now up to management to assume the role of a good football coach and say, regularly, "You're doing a good job, men, but we've got to lick the enemy, so get in there and fight!" —*S. W. Selden Mechanical Department, R. F. & P.*

EDITORIALS

Tell Us Again!

The past year has witnessed one of the most remarkable performances in the history of railroading. The roads succeeded in handling the largest volume of traffic in their history only because they pressed into active service a higher percentage of their locomotives than ever before. But still more must be accomplished and the problem is how to do it. Studies made by individual railroads indicate that a locomotive is in the hands of the mechanical department, at terminals, from four to eight out of every 24 hours of the day. The problem is *How can the time of locomotives at engine terminals be reduced?* Can improvements in inspection methods, servicing methods, or repair methods help to reduce terminal time? What improved facilities would help in this respect? Your answers to these questions will constitute our roundtable in the May issue. Your letter must be in our New York office not later than April 16.

How Mechanical Workers Are Trained on The Railways

Information has come to us from various sources that there is a misunderstanding on the part of some Selective Service Draft Boards as to the advisability of deferring skilled workers in the railway mechanical departments. The assumption on the part of some of these boards seems to be that since specialists can be quickly trained for certain types of production work in the manufacturing industries, it will be just as easy to quickly train men to maintain and repair railway cars and locomotives.

The railroads never have looked to the vocational or trade schools for such workers. It has been the practice to train them "on the job," either through thorough apprenticeship, or by the development of helpers who are employed to assist the mechanics.

Safety Paramount

Why has this "on the job" training of skilled workers in the mechanical department been considered so necessary? Safety is, of course, paramount in railroad operation. The mechanic must know when the job is completed that a locomotive is safe to despatch on its run; or that a freight car has been properly repaired; or that the safety appliances meet specifications; or that a car is loaded in accordance with A.A.R. rules; or that the loading is within the prescribed clearances for high and wide loads over the connecting lines to destination. It is true that foremen are available to advise and direct the workmen, but, on the other hand it is also true that the foremen cannot personally see and pass upon every job. Most of such responsibilities must be delegated to the workmen. In the case of a repaired car or locomotive even a loose bolt might be responsible for the derailment of the locomotive or train, with loss of life and heavy damage to property. That is why safety is of such vital importance in railway work.

Essentially Repairmen

While it is true that some new equipment is built in railroad repair shops and some parts for maintenance are manufactured, by far the majority of the workers are essentially repair men. Workers for assembly lines or for operating machines in production shops may be trained in short, concentrated instruction periods at vocational or trade schools. This, however, is not true of skilled railroad mechanics, and particularly those who work on repair operations, or in enginehouses or on the rip tracks. These workers, to a certain extent, must be able both to diagnose the trouble and to make the necessary repairs. To do this they must have an all-around knowledge of their trades and must understand the service requirements of the particular piece of equipment on which repairs are being made. They must not only understand the functioning of the particular part, but must also know its relationship to other machine or equipment parts.

Training "on the job" serves to develop judgment

in a workman, or a degree of discernment that makes it possible for him to decide whether a freight car should continue to destination or be sent to the shop track for repairs; or whether a locomotive with a leaky firebox should be continued on its run, or have the fire drawn and the leaks repaired. All these are questions of judgment. While it is true that the foremen usually take responsibility in matters of this sort, they cannot possibly follow through in detail all of the work performed by the mechanics, and greater reliance must therefore rest upon these employees than upon the industrial production workers.

It may be suggested that the problem is partly one of providing additional supervision, but under present circumstances this would simply make an additional drain upon the available skilled mechanics and would not serve to release additional men for other purposes.

Diversified Tasks

Women with no previous mechanical or practical training are today being trained for production work as welders in manufacturing plants. In contrast to this, the average welder in a railroad repair shop, instead of making one particular weld with the same rod, and with the same flux, and in the same position, day after day, is called upon for quite diversified jobs. Many of these welders must be qualified to make either acetylene or electric welds. For one hour a welder may be building up a wearing surface with a particular grade of bronze or steel; in the next hour he may be welding a fractured part, using either the electric or the acetylene process. Next he may be called upon to make a locomotive frame weld, either by the electric or acetylene process. He may finish up the day by being called upon to make an overhead electric weld in a locomotive firebox. It requires very little imagination to visualize the limitations of a "six weeks welder" in a railroad locomotive or car repair shop.

Under present conditions every possible effort must be made to train sufficient skilled mechanics to meet the unusual demand in the railroad shops, enginehouses and repair yards without resorting to "off the job" training methods. The task is being tackled in different ways in different places, and under widely varying conditions. Among some of the suggestions that have been offered to protect the situation are the following:

A Few Suggestions

1. Discontinue appointing regular apprentices (ages 16 to 21) for the duration and appoint helper apprentices, confining the selection to such employees as are married, with dependents, and are not immediately subject to the draft.

2. Continue employment of men eligible for retirement under the Railroad Retirement Act as long as they are physically able to work.

3. Negotiate agreements with the labor organizations that will permit upgrading helpers to mechanics.

4. Permit the appointment of helper apprentices that are over 30 years of age by relaxing the maximum age requirement.

5. Intensify the training of apprentices so that they may become skilled mechanics before the completion of their scheduled apprenticeship.

While trade and vocational schools can train men and women who are acceptable for employment in railroad shops in certain isolated cases of specialized work, they are no solution of the problem of replacing railroad mechanics inducted into the armed services.

Too Much Army May Lose the War

Wars inevitably involve taking great risks. This fact distinguishes the management of military affairs from the management of civilian affairs. In order that they may control the extent and danger of these risks as fully as possible, military leaders have usually received first call on men and material in time of war. This was the common-sense course to take when wars involved only a part of the resources of a nation.

Today the needs of our military establishments have been multiplied many times since the first world war. A bewildering variety of mechanized tools for offense has led to the creation of a corresponding variety of specialized tools of defense. Even in the matter of clothing many new types have been developed to meet a great variety of field conditions.

But that is not all. There is lend-lease, which must draw heavily upon our resources of foods, industrial materials and manpower if the military efforts of the United Nations that are directly in contact with the Axis powers are to be kept effective. Then there is the problem of saving the starving populations overrun by the Axis powers which is expected to increase heavily the draft on our food resources somewhat in proportion to the military success of the United Nations' forces. To meet all of these urgent necessities requires the mobilization of the activities of every adult person and some of our children. With normal activities reduced practically to a subsistence level there remains little to distinguish civilian from military in point of importance to the successful prosecution of the war.

This is a situation, the control of which is beyond the competence of our military leadership, because it calls for the exercise of broader knowledge and understanding than training for military leadership can be expected to impart.

Up to a point, no doubt, the faster our armed forces are built up and the greater their ultimate number, the sooner and surer will be our victory. But to go so far in insistence on the last ounce of energy in this direction as to impair the capacity of the transportation system at home is trading a military risk of uncertain magnitude for one at home the effect of which can be evaluated with far greater certainty—a general slowing

down of the entire program of production and distribution which, in turn, will reduce the size of the armed forces which can be employed effectively at any given time.

There seems little doubt but that our military leaders are aware of the importance of transportation to the effectiveness of the nation's military operations. But there is grave doubt whether they are aware of, or are competent to interpret, the facts which point to the end of reserve capacity to cope with the prospective load on our railways. During the first 11 weeks of 1943, carloadings, excluding merchandise less car load, increased three per cent over last year. The increases were principally in coal and grain loadings. Henry F. McCarthy, director of the Division of Traffic Movement, ODT, in an address before the New England Shippers' Advisory Board on March 18, declared that the increase in turn-around time has in effect reduced the box car supply by 4.2 per cent and the open-top car supply by 6.8 per cent as compared with last summer.

Joseph B. Eastman has warned that it may soon be necessary to resort to a system of transportation priorities to protect so-called essential war transportation. Should that be done, then there has already been a serious failure of transportation. When materials and labor are as badly needed as at present, it is little short of criminal to waste them in production made ineffective by lack of opportunity for distribution. Furthermore, as our production of materials other than those directly involved in the conduct of the war approaches subsistence level, the application of transportation priorities will impair the morale and slow down the tempo of war activities.

Warnings have been sounded, both in and out of Washington, of the need for more motive power and freight cars, for more materials and manpower. Unless the seriousness of these warnings is grasped and they are acted upon the United States can be defeated by the grandiose proportions of its military plans.

Has the Need For Progress Ceased?

Within the past month a meeting of officers representing the coordinated mechanical associations (Boilermakers, Car Department Officers, Railway Fuel and Traveling Engineers, and Locomotive Maintenance Officers') was held at Chicago to consider the problems with which these associations are faced under the difficult conditions of the present time and to develop the policies under which they will operate for the duration. At that meeting the first three of the above groups voted to continue operation on much the same basis as has prevailed during the past year; namely, to forego the holding of a convention or exhibit but to continue the work of the various technical and business committees and to make the reports of the committees available to their members and the industry generally through publication in their annual proceedings or in trade journals, such as the *Railway Mechanical Engineer,* or in some cases, by both means.

It is with concern that we learn that the Locomotive Maintenance Officers' Association notified the co-ordinated associations group at the Chicago meeting that it had decided to suspend all of the association's activities, including the collection of dues, for the duration. If we are correctly informed, the reason why this action was taken was because its members are so completely engaged in their work on the railroads that they have no time to devote to association work.

It has long been our belief that in times of great national emergency, such as we are now going through, a democracy, while slower in getting started toward an objective that may contribute to ultimate victory proceeds with great rapidity, once started. Its people not only are encouraged to work together toward a common end, but they know from three centuries of expeirence that widespread trading of ideas will assure that a group, or a people, will make progress in direct proportion to the extent to which that idea is carried out. The same basic philosophy applies to any organization, the objectives of which are to promote progress within a group, an industry, or even a nation. We have never felt that any justification was needed for the continued existence and activity of any organization functioning in such a manner that its membership was aided by its work.

We can not help but wonder if the officers of the Locomotive Maintenance Officers' Association were fully conscious of the significance of their decision. Is there no need for the work of such groups as this and is it true that its members might more profitably devote their time and energies only to their daily tasks? If that is the case, then the many national technical societies such as the mechanical, civil, electrical, chemical and metallurgical groups, that are now contributing so richly to the war effort are wasting hundreds of thousands of man-hours—mostly overtime man-hours, too—that might more profitably be directed into — what?

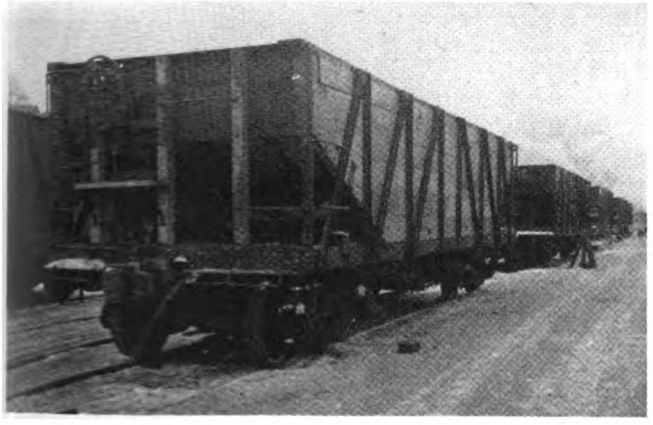
These questions are not asked in a spirit of criticism. They are asked because the editors of this publication have a firm conviction that the work of the Locomotive Maintenance Officers' Association is needed more in 1943 than it has been needed in the past.

In all fairness to the association's officers it may be said that the absence of positive encouragement on the part of many chief mechanical officers may have been interpreted as an indication that the results of this association's efforts have not been such as to justify its continued support on the part of the railroads. If there are those who feel that way, the best interests of the mechanical department will be served by a frank and open discussion of this subject, for they can ill afford to give acquiescence, by silence, to a suggestion that there is no time to be spared in an effort to improve locomotive maintenance facilities and methods. That is what the suspension of this association's activities suggests.

With the Car Foremen and Inspectors

Car Repairs in The Anthracite Region

The substitution of wood for steel in the repair of open-top cars has created no problem for the working forces at the Carbondale, Pa., repair tracks of the Delaware & Hudson when cars of composite construction require attention. These tracks are located near the source of



After painting this repaired composite type car will move to a nearby colliery to load anthracite

much of the anthracite which the road carries. Most of the work performed on cars is light in nature but some repairs are made to open-top cars, particularly those of the composite type which the company is continuing in the coal trade. This work is performed under a modified spot system. Cars are stripped to the extent necessary and are then rebuilt using both new and reclaimed materials. Generally the work consists of straightening posts, braces, top chord angles and side sills, and renewing side planking, wooden slopes and doors. Extensive use is made of reclaimed materials and good sections of removed planking are used in light repair work.

Material handling is expedited by the use of a gasoline crane truck equipped with a telescopic boom. Operations are greatly facilitated by the provision of concrete runways along the repair tracks which are of especial value in inclement weather.



Material handling and repairs are expedited by the use of a gasoline crane truck operated over concrete runways

An Effective Wood Saw Guard

Although woodworking is one of the most hazardous operations in industry, the mill room of the Pullman car repair shops at Calumet (Chicago), Ill., has had a perfect safety record for nearly 14 years. In all of these years not a single lost-time injury has been incurred in this department, according to Harry Guilbert, safety director of the Pullman Company, who attributes the record to "painstaking employment of every possible human and mechanical precaution." The significance of this performance is emphasized by the fact that the woodworking industry, in 1941 for example, had an accident rate of 22.4 per million man-hours of work, or nearly one-third higher than the overall rate of industry.

The illustration shows Mr. Guilbert inspecting a new safety guard developed by George Gibson (left), foreman of the mill room. Said to be the only device of its kind in the country, the guard is adjustable, so that it may be dropped down to shield whichever of the two saw blades is being used. The blades are both turned up to cutting position for purposes of illustration, but in actual service only the blade being used is above the surface of the table.

The new guard not only protects the operator against the cutting teeth of the saw blade itself, but eliminates the great woodworking hazard of "kick-back." In unprotected operations, the teeth of the saw may dig into the work which is being withdrawn by the operator and hurl it forward with the velocity of a projectile. An unguarded blade may cause the loss of a finger, but "kick-back" often results in death.

Referring to the illustration this general construction of this saw guard is readily apparent. It consists of a steel guide block *S*, rigidly supported and braced about 4½ ft. above the saw table and having a horizontal hole large enough to accumulate a closely fitting piece of 2½-in. pipe *H* which has a pipe cap threaded on the right end and is beveled and securely welded on the left end to a longer vertical section of 2½-in. pipe *P*. Pipe *P* is grooved at the bottom to receive a key which fits a corresponding slot in block *S* and prevents pipe *H* from turning. By lubricating the smoothly-finished pipe *P*

lightly, however, it is free to move horizontally, being locked in either extreme position (with the guard covering a saw) by a pin through block *S* and the pipe *P*.

The saw guard *G*, made of sheet metal of the shape shown, is welded to a short section of 2-in. pipe which telescopes inside pipe *P* and is supported by a wire cable extending up to a small pulley wheel and thence downward to a counterweight which moves up and down in



A saw safety guard used at the Calumet car repair shops of the Pullman Company

guide pipe *W*, lightly welded to the side of pipe *P*. This counter-weight is just heavy enough to permit the saw guard to move downward by its own weight and rest lightly on the saw table. Saw guard *G* is prevented from swinging by the pin through block *S* and pipe *H*. It is held parallel with the saw by a spline on the 2-in. telescoping pipe which engages a narrow groove cut in the back of pipe *P*, as shown in the illustration. The saw guard can be locked in the raised position by a hand knob and holding screw, also illustrated, when it is necessary to see the saw in making adjustments for varying widths of lumber to be ripped or cut off.

In operation, a piece of lumber is pushed through the saw, easily raising the guard on entrance and permitting it to drop over the saw again at completion of the cut. In case the piece of lumber cut off has to be pulled back past the saw, the guard prevents any possibility of contact with the rapidly revolving saw teeth.

In 1942 the Pullman Company had a perfect safety record in its shops throughout the country. In 7,000,000 man-hours, embracing almost every type of industrial occupation, there were no lost-time injuries, one of the few times such a mark has been achieved in a major industry.

Safe Handling Of Leaky Tank Cars*

The acute shortage of petroleum products in certain sections of the country has made it imperative that during the emergency every available tank car should be placed in this type of service in an effort to relieve the situation.

An investigation of some of the delays to loaded tank cars show that many loads of inflammable liquids are being transferred due to slight leaks or seepages of tanks which could be moved to destination without any appreciable hazard or loss of contents.

To assist those directly connected with handling such defective tank cars, the following suggestions are offered with the idea of facilitating movement of this type of equipment with a minimum of delay.

Safety Precautions

If a car tank is leaking more than 30 drops per min. at any one location, which leak cannot be stopped by methods given below, then the car should be moved away from all open flames, fires, switch lamps, etc. The tank should then be relieved of all interior pressure by cooling with water or venting the tank by raising the safety valve on the dome at short intervals. If venting to relieve pressure will cause a dangerous amount of vapor to collect outside the car, venting must be deferred until pressure is reduced either by cooling with water or by allowing the car to stand a sufficient length of time.

If the dome cover is removed for the purpose of determining whether the outlet valve is seated, the following instructions must be followed:

(*a*) *Screw type dome cover*—The cover must be loosened by placing a bar between the manhole cover lug and knob. The bar should be covered with rags or burlap to avoid sparking. After two complete turns, so that the vent openings in the cover are exposed, the operation should be stopped, and if there is any sound of escaping vapor, the cover must be again screwed down tightly and the interior pressure relieved as prescribed above before again attempting to remove the cover.

(*b*) *Hinged and bolted type*—All nuts must be unscrewed one complete turn, after which the same precautions as outlined above must be followed before attempting to remove the cover.

(*c*) *Interior type*—All dirt and cinders must be carefully removed from around the cover before the yoke is unscrewed. (Failure of the interior cover to drop from the seat is an indication of interior pressure which must first be relieved before again attempting to open the cover.) It is well to point out that the hinged and bolted type, as well as the interior-type covers, may have gaskets frozen on their seats necessitating slight tapping to loosen them. A piece of wood or a wood mallet should be used for this purpose. *Never use a metal tool which will throw off sparks.*

Any inflammable liquid found on the ground should be covered immediately with fresh dry sand, dirt or cinders.

Tanks with Cracked Sheets or Leaking at Rivet

Tanks leaking due to cracked sheets are a definite hazard and the lading should be transferred. While a crack may be small at the time of inspection, further movement of the car may cause the crack to progress with the result that the entire load may be lost.

* Circular letter to members and private tank car owners, issued by the A.A.R. Mechanical division under date of March 2.

Tanks leaking at seams or rivets over 30 drops per min. at any location are a hazard. If such leakage can be reduced to 30 drops per min. or less by making temporary repairs, the car should be allowed to proceed. If unable to reduce this leakage to 30 drops per min. or less, then the contents should be transferred and the tank properly repaired before being returned to service.

Tanks leaking over 30 drops per min. can be given temporary repairs in many cases that will eliminate the necessity for transferring contents. Leakage at seams or rivets can be eliminated or reduced, in most cases, by the use of various caulking compounds. Ordinary yellow laundry soap has been used with good results in stopping leaks at seams or rivets where the car has only a short distance to travel. Another method is to force fine lead wire into the seams at the points of leakage. All of these caulking operations should be performed with a wood mallet and a sharp pointed hard wood stick. *Never use a metal tool which will throw off sparks.*

Tanks Leaking at Outlet Cap

Leakage at the outlet cap may be due to several causes. Possibly the outlet cap is loose or the basket is defective and leakage is due to the accumulation of liquid inside the outlet casting, caused by the outlet valve not being properly seated, or the seat of the outlet valve slightly worn.

In such cases where the leakage is greater than 30 drops per min., the attempt should be made to stop the leak by tightening the outlet cap with a wrench at least 48 in. long. If this does not stop the leak, it may be that the basket is defective or missing; in which event it then becomes necessary to remove the dome cover (see instructions under safety precautions) to see if the valve is in the closed position. This can be done by operating the valve-rod handle or wheel a few times. If the valve is found to be closed, replace the dome cover and remove the outlet cap very slowly. If the flow of liquid comes in force it indicates that the valve is not in the closed position and therefore the lading should be transferred.

If loosening the outlet cap indicates that there is a slight leakage through the outlet valve, it may then be possible to stop the leak by removing the cap and applying a new gasket.

When removing valve caps, keep a pail under the outlet leg to catch the contents to avoid spreading.

Tanks Leaking at Tank Head Plugs

If the plug is applied from outside the tank head, then attempt to eliminate or reduce the leak by tightening the pipe plug. If this tightening does not reduce leakage to 30 drops per min. or less, then the contents must be transferred.

If the tank plug is applied from inside the tank and leakage exceeds 30 drops per min., then the contents must be transferred.

Tanks Leaking at Heater Coils

Any leaks at heater pipe caps or at threaded joints of inlet or outlet nipples indicate that the coils inside the tank car are defective. Such leaks outside of the tank may be eliminated or reduced to 30 drops per min. or less by tightening the coil caps and nipples.

In cases where loaded tanks have been given temporary repairs and allowed to proceed to destination, the tank must be stencilled "Leaky Tank" and an "X" placed at the points of leakage. The car owner should be immediately notified by telegram that the car has been allowed to proceed to destination with temporary repairs and must be inspected and properly repaired before it is again loaded.

Air Brake Cut-Out Cocks Closed

There have been numerous delays to tank cars due to the fact that air brakes have been cut out where no defect in the brake equipment existed, causing unnecessary shopping and delay. In tracing to find the cause for closing the cut-out valve, it has been found that employees at loading and unloading racks have closed the valve handle when removing or applying the outlet valve cap on account of alleged interference of this handle with the removal of the cap. After their work has been finished, they have failed to open the cut-out cock.

It is very important that workmen at the loading or unloading racks be instructed never to open or close the cut-out valve, nor to interfere with any portion of the air brakes on the cars while they are loading or unloading tank cars. Instructions should be issued to the proper parties so that delays due to this cause will be avoided in the future.

Better Tools Needed for Car Repairs*

By F. G. Moody

There is good and sufficient reason for predicting that the number and percentage of bad order cars will gradually increase, unless car repair facilities and methods are improved to the extent necessary to compensate for shortage of material and labor.

We are fully cognizant of the fact that no attempt should be made at this time to modernize car repair plants completely by replacing old and obsolete heavy machine tools, but I dare say there are few, if any, of our larger shops and repair tracks which are not sorely in need of additional small tools, such as high-speed jacks, welding machines, rivet forges, riveting hammers, air motors, motor hoists, and numerous other small tools. Wholesale placement of orders for these items is not suggested, as it is believed careful study will show that a relatively small quantity strategically located will suffice, but these are some of the items which should and must be provided to offset the shortage of labor and to expedite and increase output of repaired cars.

The more intensive utilization of all freight cars coupled with a very substantial decrease in the number of cars now receiving general repairs has already resulted in an increasing number being taken out of service account of bad order, and as there are still a large number of cars in service that are from twenty-five to thirty years old and which under normal conditions would have been taken out of general service long before this, it is reasonable to expect that as a result of overloading based on actual physical condition, greater mileage and higher speeds, they will become bad order at a more rapid rate than heretofore.

Under present conditions, these old worn out cars cannot be replaced or rebuilt in kind, but in their pres-

* Part of the discussion presented at a meeting of the Western Railway Club, held at the Hotel Sherman, Chicago, on Monday evening, March 15, 1943. The discussion, prepared by Mr. Moody who is superintendent of the car department, Northern Pacific, was presented by his assistant G. H. Wells.

ent advanced state of deterioration and obsolescence they require frequent repairs which result and will continue to result in an ever increasing number of cars marked bad order; therefore, to compensate in the fullest degree possible for shortage of labor and increased amount of work with which we are now confronted and which must be done, careful study and planning on the part of supervisors in an effort to obtain maximum use of existing facilities is of paramount importance. In many cases, much may be accomplished through slight re-arrangement of tools and facilities to obtain this. For example, the rapidly increasing number of wheel changes being found necessary calls for consideration being given to the question of improvements in storage and handling facilities, to lessen the labor of handling wheels at wheel shops and on repair tracks.

Mounted wheel storage tracks should be conveniently located in relation to service and repair tracks where wheels are changed. Suitable hoists or cranes should be provided for quick and efficient loading and unloading of mounted wheels and other heavy materials. At secondary and smaller repair tracks, simple hoists, transfer dollies, etc., which will greatly speed up the work and reduce labor required to change wheels, truck sides and truck bolsters can often be made from available scrap and obsolete materials.

As a means of preventing avoidable waste of man hours, adequate transportation should be provided. In many cases this can best be accomplished by furnishing company-owned automobiles and delivery type trucks for use of employees who are required to travel relatively long distances in the performance of their duties, especially at large terminals, and when called upon to make emergency repairs to cars at remote locations. Furnishing of such transportation will speed up the work and thereby insure delivery of cars to destination with minimum detention account of bad order, and also will insure prompt return of men to their home point.

Finding Leaks In Brake System

*By P. J. Hogan**

Freight cars are often set out of trains at points where no compressed air is available for the repairman to check the brake system before certifying the car as being fit to move after other necessary repairs have been completed. The following is an outline of a simple method which will give satisfactory results in determining whether the air-brake system is free from leaks. Use of it will eliminate the possibility of train delays caused by returning cars to service with faulty or broken piping. The operations are as follows:

1—Close the angle cock at one end of the car.

2—Kink the air hose by doubling it and placing the coupling head in a position to keep the hose kinked during the test. This will guard against loss of air from a leaking angle cock.

3—Open the auxiliary reservoir drain cock and keep it open during operation No. 4.

4—Open the angle cock on the opposite end of the car to that mentioned in operation No. 1. Then cover the air-hose gasket opening with your mouth, take a fairly deep breath and blow into the hose without allowing any breath to escape at the gasket. This will move the triple piston to the release position.

5—Close the auxiliary reservoir drain cock and make sure that it is well seated. This can be accomplished by shaking the drain cock handle.

6—Proceed as in operation No. 4 by blowing into the air hose. Hold your breath for about three seconds. If the pipes are tight, your breath will back up to your mouth. This will indicate that the system is tight and that no pipes are broken. A leak in the system is indicated if your breath moves away and does not return.

7—If the system is found to be leaking, close the cut out cock in the branch pipe and again proceed as in operation No. 4 by blowing into the air hose. This time if your breath returns to your mouth it indicates a tight brake pipe and is evidence that the leak is on the auxiliary side of the cut out cock. This calls for a close examination of the remaining portion of the brake-pipe branch, auxiliary reservoir and its drain cock. If your breath moves away slowly at the time of the test with the cut-out cock open, it is possible that the leakage is in the seat of the drain cock, or that the atmosphere is being compressed in the auxiliary reservoir through the feed groove.

8—Auxiliary reservoir leakage can be determined by blowing into the air hose a few times, holding your breath for about two seconds each time, then opening the auxiliary reservoir drain cock and while doing so listen carefully for escaping air. If the system is tight quite a pronounced puff of air will be heard. When making this test, if leakage develops, the leak can be heard by a second party if he listens carefully along the pipe line at the suspected area while the atmosphere is being compressed.

9—If the car undergoing the test is located at a point where the condition cannot be remedied, and the brake pipe is tight to the cut-out cock, it will be known that the car can be handled in a train, with the brake cut out, to a point where repairs can be made.

Operations Nos. 1 and 6 are the essential items in this test and require approximately two minutes time.

* Supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

164—*Q.—What provision is made to prevent release of the emergency application before the train comes to a stop?* A.—Quick-action chamber air of the vent valve is vented through choke *20* in piston *42*, and a second choke *67*, in adjacent cover, the chokes thus timing the release of the quick-action chamber air from passage *t-2* to a definite interval, after which a spring closes vent valve *40*. This insures the vent valve remaining open long enough to provide positive transmission of quick action, prevents the release of emergency applications prematurely and then closes the vent valve exhaust to allow recharge of the brakes.

165—*Q.—How does the brake equipment operate when operated by a steam locomotive in automatic service?* A.—This operation will be described later. The double check valve *228* (Fig. 17) is moved to its left-hand seat, closing off the straight-air pipe passage *8a* and establishes connection from the service port *3a* to the relay pipe *16*.

Setting and Maintaining

Flues Without Copper Ferrules*

Part II

By S. Christopherson†

Procedure for welding tubes in the sheets—Maintenance of welded tubes—Application of arch tubes

All holes in the back flue sheets for flues and tubes should have the inside and outside edges rounded to a radius of 1/16 in. to prevent cutting of the flue or tube. This is important when copper ferrules are not used and should be insisted upon to insure a good job. On an old sheet, when holes have become enlarged 3/16 in. above the nominal diameter of the flue hole, the sheet

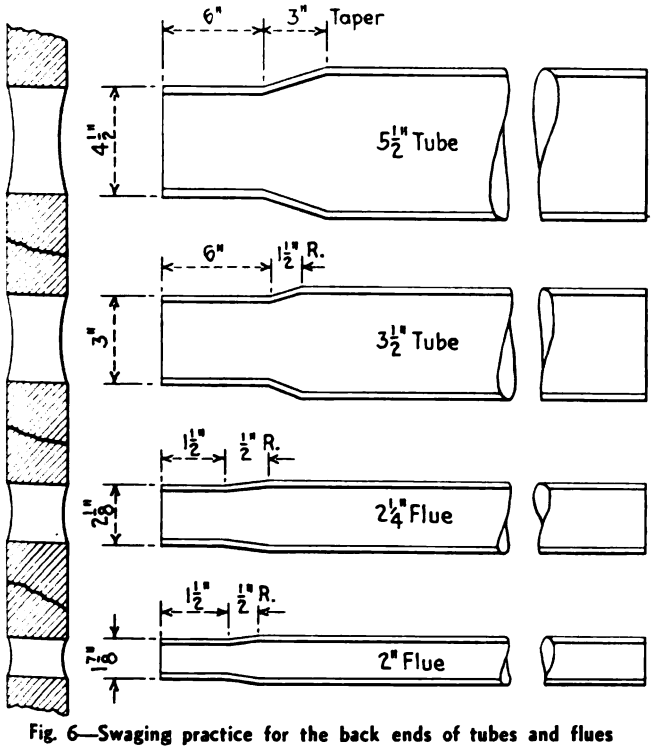


Fig. 6—Swaging practice for the back ends of tubes and flues

should be removed and scrapped. When using old sheets, when copper ferrules are eliminated, the 2-in. and 2¼-in. flues should not be swaged.

On old sheets, when copper ferrules are eliminated, the 3½-in. tubes should be swaged in accordance with the diameter of the hole found on each job. The same is true for the 5½-in. tube.

It is recommended that in this change of eliminating the copper ferrules new swaging dies be made for the new back flue-sheet holes and that the old swaging dies be bored to suit the old holes in the old sheets.

Holes for 2-in. and 2¼-in. flues should be 1/32 in. larger in diameter than the outside diameter of the flues. Holes for 3½-in. tubes should be 3/32 in. large, or 3 19/32 in. in diameter. Holes for 5½-in. flues should be 3/32 in. large, or 5 19/32 in. in diameter. All holes should have the inside and the outside edges rounded to a radius of 1/16 in. to prevent cutting of flues and tubes.

Flues and tubes should be tightened in the front flue sheet with a roller expander having flaring rolls. When holes have become over-size, the use of a galvanized-iron shim 5/8 in. wide is recommended. The shim should extend completely around the flues and tubes with the ends scarfed and lapped ½ in.

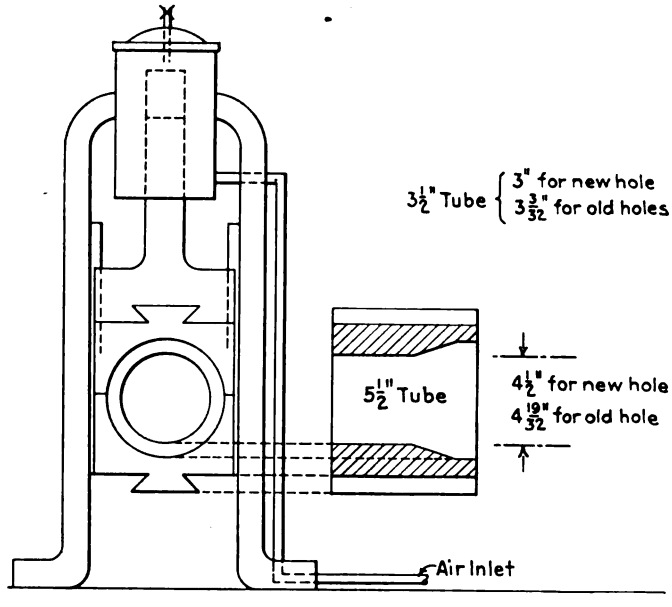


Fig. 7—Size of swages to be used when copper ferrules are eliminated

* Abstract of a paper submitted as part of the report of Committee on Topic No. 2 on the application and maintenance of boiler flues for the 1942 year book of the Master Boiler Maker's Association. Part I appeared in the March issue.

† Mr. Christopherson, who was vice-chairman of the Committee on Topic No. 2, is supervisor boiler inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.

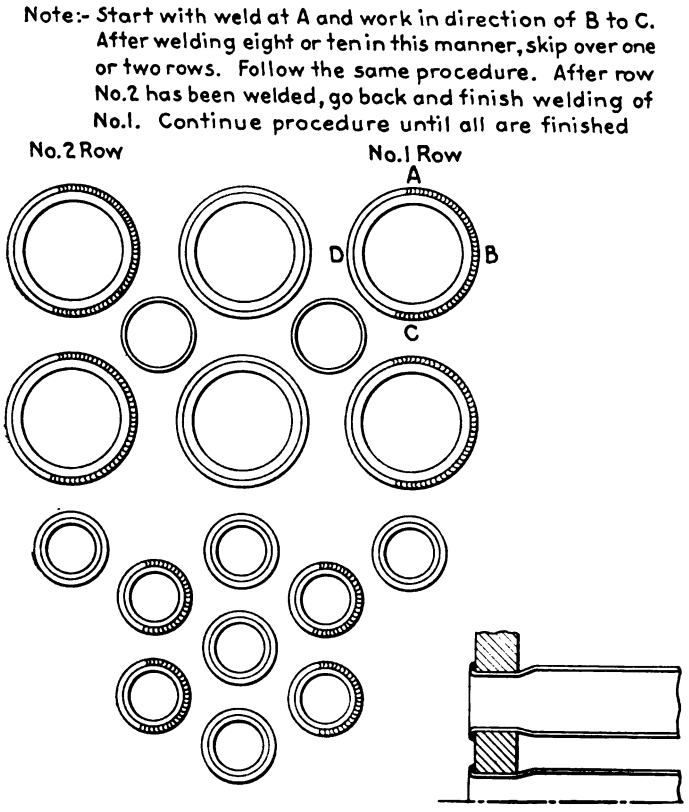


Fig. 8—Sketch of procedure for welding tube and flue beads

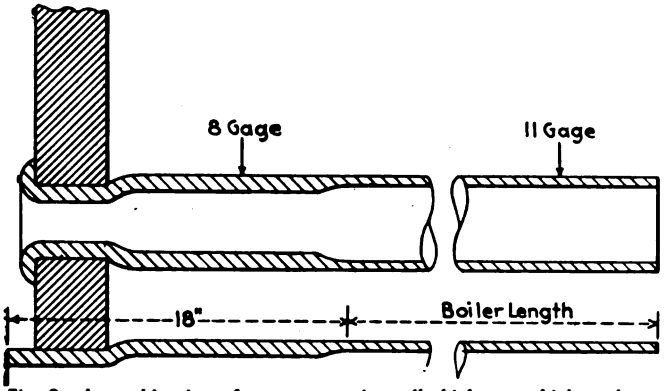


Fig. 9—A combination of two gauges in wall thickness which prolongs tube life under cinder cutting

All flues and tubes should be made perfectly tight and thoroughly cleaned before welding is started. The use of a portable sand-blast machine is recommended. The welding should be done with the boiler empty immediately after the flues are sandblasted or cleaned. Welding should be done with straight-polarity shielded-arc electrodes, using ⅛-in. electrodes for 2-in. and 2¼-in. tubes and 5/32-in. electrodes for 3½-in. and 5½-in. flues. Care should be taken to avoid concentrating the heat of welding too long on any area of the flue sheet and the following procedure is recommended.

The 5½-in. superheater flues should be welded first. Work should progress on vertical rows of tubes and flues starting with the top tube or flue and proceeding downward. Start the arc at the top of the tube or flue and weld downward, taking half a tube or flue at a time.

After welding eight or ten tubes or flues in this manner, jump over one or two rows and follow the same procedure. After the second row has been welded, the first row will have cooled sufficiently for further welding. Go back to the first row and clean all scale off the work and then weld the other half of the first row. Overlap the welds at the top and bottom to make certain that there is good fusion.

Skip over one or two rows beyond the second row and weld one half of a row, then return to the second row and finish the remaining half. This procedure should be followed and continued until all the flues and tubes have been welded. It is not necessary to clean the scale from the welds where no further welding will be done as the fire will burn it off.

Maintenance of Welded Flues and Tubes in Service

Heavy working of an electrically welded flue or tube may cause leakage of each of the adjacent flues or tubes. Care should be taken in performing this work.

When flues or tubes are leaking so badly at the fire-box end that the locomotive must be taken out of service, the boiler should be drained. The welding on all defective flues or tubes should be cut off and they should be reset with a straight sectional expander; beads should be reset with the beading tool. Flues should be cleaned and rewelded. Tubes should be made tight by the use of a roller expander, rolling lightly; beads should be reset with the beading tool, cleaned and rewelded. If welding facilities are not available, reweld at the first opportunity.

Pin holes in the weld should be caulked with carded tool and hand hammer. Leaking will disclose these defects. The pein of the hammer or a beading tool should never be used. If the leak is under a weld, cut off the defective portion of the weld and reset the flue with a straight sectional expander; roll and bead the defective portion lightly. Clean and reweld.

All the flues and tubes should be inspected not less frequently than at boiler-wash periods and each time the fire is dumped or the locomotive reported as steaming poorly. If found to be plugged, the flues and tubes should be blown, using not less than 90 lb. per sq. in. of air pressure. A flue-blowing pipe not less than the full length of the flue or tube is required. Any clinker formation found on the return bends of the superheater units should be removed with a hook.

Cinder Cutting

We have had very good results from tests of heavy-gauge flues attached to those of lighter gauge. These

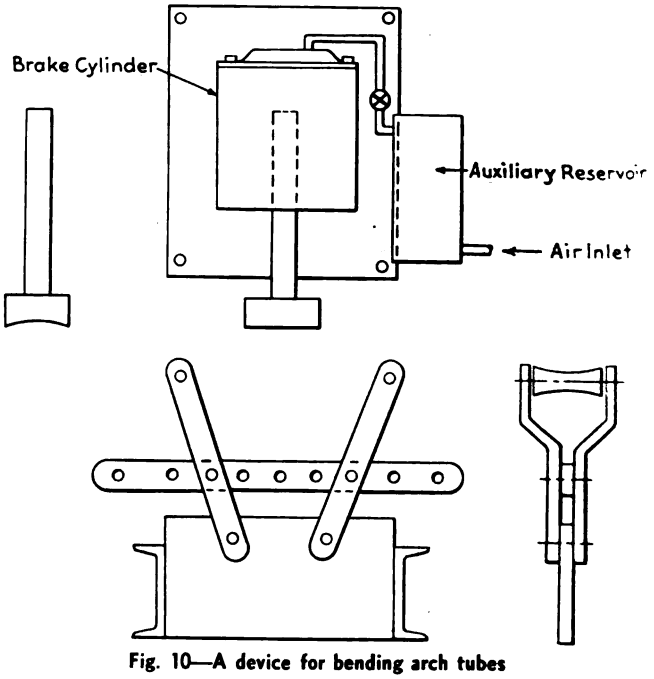


Fig. 10—A device for bending arch tubes

flues were applied to ten 4-6-4 type locomotives carrying 285 lb. boiler pressure during the period from November, 1940, to July, 1942. Up-to-date, these engines have made as many as 200,000 miles and no trouble has been experienced with cinder cutting.

Cutting, Application and Setting of Arch Tubes

Arch tubes should be cut in a pipe or other suitable machine. The acetylene torch should not be used. Ends should be free from burrs and be closely fitted into the

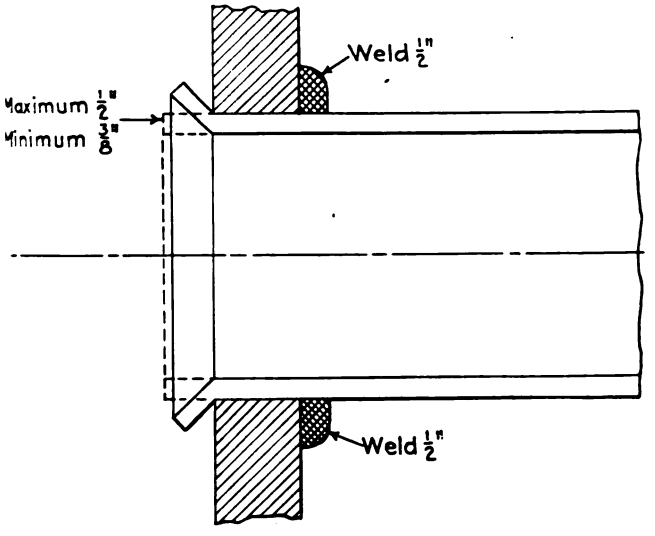


Fig. 11—A method of reinforcing the door sheet around arch-tube holes

firebox sheets. Tubes should be so bent that they will enter both holes at right angles to the sheets. Care should be taken in bending to prevent overheating, distortion, or kinking of the tube at the bend. The projection of the arch tubes for belling should be 3/8 in. minimum to 1/2 in. maximum.

Tubes before being cut should be at least 3 in. longer than the finished length required. Tubes should then be bent and tried out in position in the firebox for marking of the true cutting length. Tubes should be set to railroad's standard gauges shown on assembly firebrick drawings. No tubes should be expanded and belled until they have been passed upon by the foreman or inspector in charge. The service life of arch tubes has been greatly improved upon by the building up of the arch-tube hole at the door-sheet end, as shown in Fig. 11. A boss has been built up with electric welding for a depth of 1/2 in., the hole reamed and the boss chamfered. This will give more bearing area and the tube will stay tight. For a period of seven years we have had no leaky arch tube when using the above method. Both ends of the tubes should be tightened, flared, or belled with a flaring roller expander. When the arch tubes have once been flared, no further flaring or belling should be done. If, for any reason, a tube is re-rolled for leakage more than twice, it should be renewed.

When renewing arch tubes, if the holes in the sheet have become oversize or distorted, they should be reamed to a true circle and the radius on the water side of the sheet restored, using a galvanized iron shim. The shim should extend completely around the tube, the ends scarfed and lapped 1/4 in. No arch-tube hole should be enlarged over 1/4 in. by reaming. At this limit a patch should be applied. All arch tubes should be cleaned with a mechanical turbo-cleaner whenever it is found necessary, but not less frequently than at boiler-wash periods.

Do not safe-end the arch tubes. The following is recommended for the duration. If the arch tubes are found in good condition after being thoroughly cleaned and inspected and the sheets are not removed for renewal at the time of a Class 3 repair, arch tubes should be left in the boiler.

Removing Carbon From Piston Valve Spools

Piston-valve spools removed from locomotives at the back shop when they come in for repairs are in most instances well coated with carbon, particularly on locomotives with high steam temperatures. The removal of this carbon coating, in many shops, is a tedious job of hand scraping. One shop takes advantage of the remaining heat in annealing or forging furnaces to put the valve spools in the furnace over night, making sure that the temperature of the furnace is not high enough seriously to affect the material of the valve spool. The next morning the coating has been loosened to such an extent that its removal is a comparatively simple matter.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

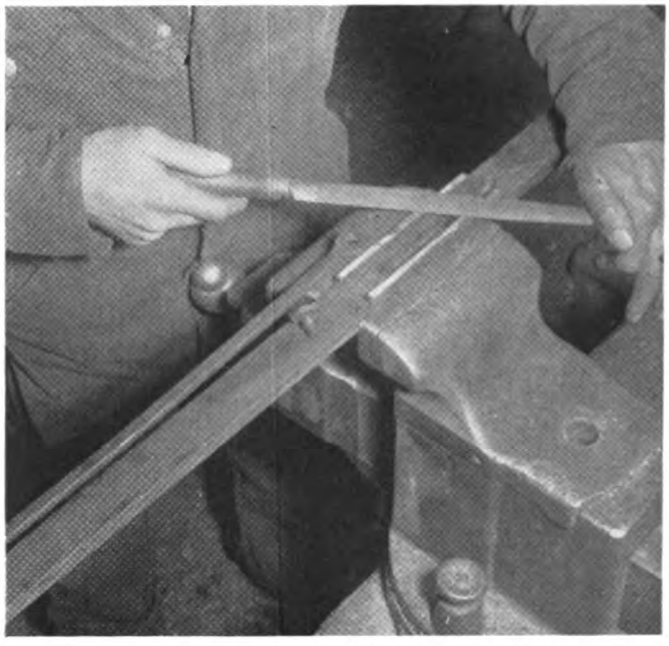
Welding Guides For Throttle Lever Latch

Q.—We have several locomotives with throttle levers of the type where the latch is supported only by one large headed bolt. This type lever develops lost motion after a few weeks service. Could you suggest a way to correct this trouble?

A.—It is obvious that to eliminate the lost motion the latch must be secured to the lever and still be allowed freedom of movement. This can be accomplished by welding two strips of 1/2-in. square stock along the sides of the lever. These strips are veed on one side and the lever is also veed along the part where the latch moves. This may warp the lever slightly but it is a simple matter to straighten it before machining. After straightening the lever the new strips are shaped out to accommodate a new latch somewhat narrower than the original one. The strips will finish 5/16 in. wide by 3/8 in. high. The new latch will be slightly thicker and narrower than the old one, but the same closing medium will be used, that is, a coiled spring in the slot prepared for it underneath the latch. The pressure of the spring is exerted against a lug on the bottom of the latch. When machining the new latch it is well to leave about .006 in. clearance so that the latch will slide freely but with no lost motion between the newly welded guides. The same large headed bolt is used to hold the latch snug in the slot. With the latch thus held securely it can not develop lost motion.

It may be found necessary to make a new latch operating rod. If so, a piece of 1/2-in. by 5/16-in. steel will serve. A piece of 1/4-in. steel 1 in. square is welded to one end of the rod and this is then ground into the shape

of a lug and drilled for the latch end cap screw. The handle end of the operating rod takes a little larger lug. This will be ½-in. thick and 1-in. square. This is also



Filing down the guides for the latch on the throttle lever

welded to the rod, then drilled and reamed for the handle pin. This end is pinned in place and the rod heated with a welding torch and bent so that it will fit in the correct position on the throttle lever. Levers repaired in this manner need little maintenance.

Aligning Cast Iron Parts Before Welding

Q.—What is the correct procedure for welding cast-iron parts having one or more bearings that must be kept in perfect alignment?

A.—As cast iron parts usually break clean without bending or pulling as in steel castings the cast iron part may be fitted together on the welding bench in good alignment. When preparing a cast iron part for welding be careful to keep one surface of the break in approximately a flat position, then when the part is blocked and shimmed to as nearly correct position as possible a small amount of the break is melted out with the welding torch. This small V is then welded. The part is then reversed and the same procedure carried out on the other side. A little more melting and welding can be done on this side. The welder now returns to the original side of the weld, being very careful to block and shim the casting so that it can not sag. More of the crack is melted out and welded and once again the casting is turned over and the same thing done on the reverse side. This alternating procedure is followed until the job is completed. By following this method almost any casting can be welded with satisfactory results.

Applying Hard Facing With The Welding Torch

Q.—What method can be used to build up worn whistle levers and brake valve latches with hard surfacing?

A.—By applying Stellite to whistle levers and brake-valve latches the wear is almost completely eliminated. Grind or file the curved end of the whistle lever to a bright finish. The worn end of a brake-valve latch is usually worn smooth and bright. Then heat the part to a dull red with a carburizing flame using about a 1-in. feather of acetylene. When the base metal starts to sweat apply a small amount of Stellite which will tin similar to bronze. When the end has a thin coating all over, build up to the desired thickness. The part can then be ground to the correct dimensions.

Special Tool Holder For the Boring Mill

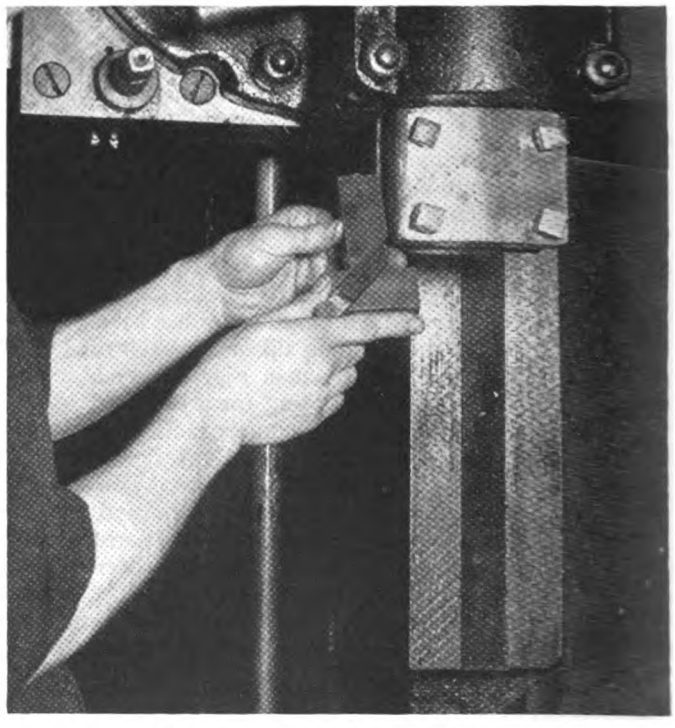
There are a great many occasions when a mechanic would prefer to use a standard tool bit but due to the type of tool post used or the inability to secure the correct size tool bit he has to be satisfied with hand-forged carbon-steel tools.

Faced with this situation a boring mill hand on a small railroad devised a holder whereby he could use ⅝-in. tool bits in a tool post designed for 1-in. tools.

The forged tools for boring had to be bent to get the correct angle of the tool to the work. A tool holder for the ⅝-in. stock was made for this purpose also.

The tool holder for the straight tool was simply a piece of tire steel 1 in. by 1¼ in. by 4 in. long. In this was milled a slot ⅝ in. by ⅝ in. The tool bit can be inserted in the holder and the set screws tightened directly onto the tool bit. In this manner the ⅝-in. tool bit serves as a regular 1-in. tool.

The holder for the boring tool was nearly as simple. This also was made from tire steel 1 in. by 1¼ in. in the shape of an inverted tee, 3½ in. wide and 4½ in. long. The ⅝-in. slot in this holder starts at the lower right-hand corner and extends across the tee at a 45 deg. angle. The top set screw in the tool post tightens on the

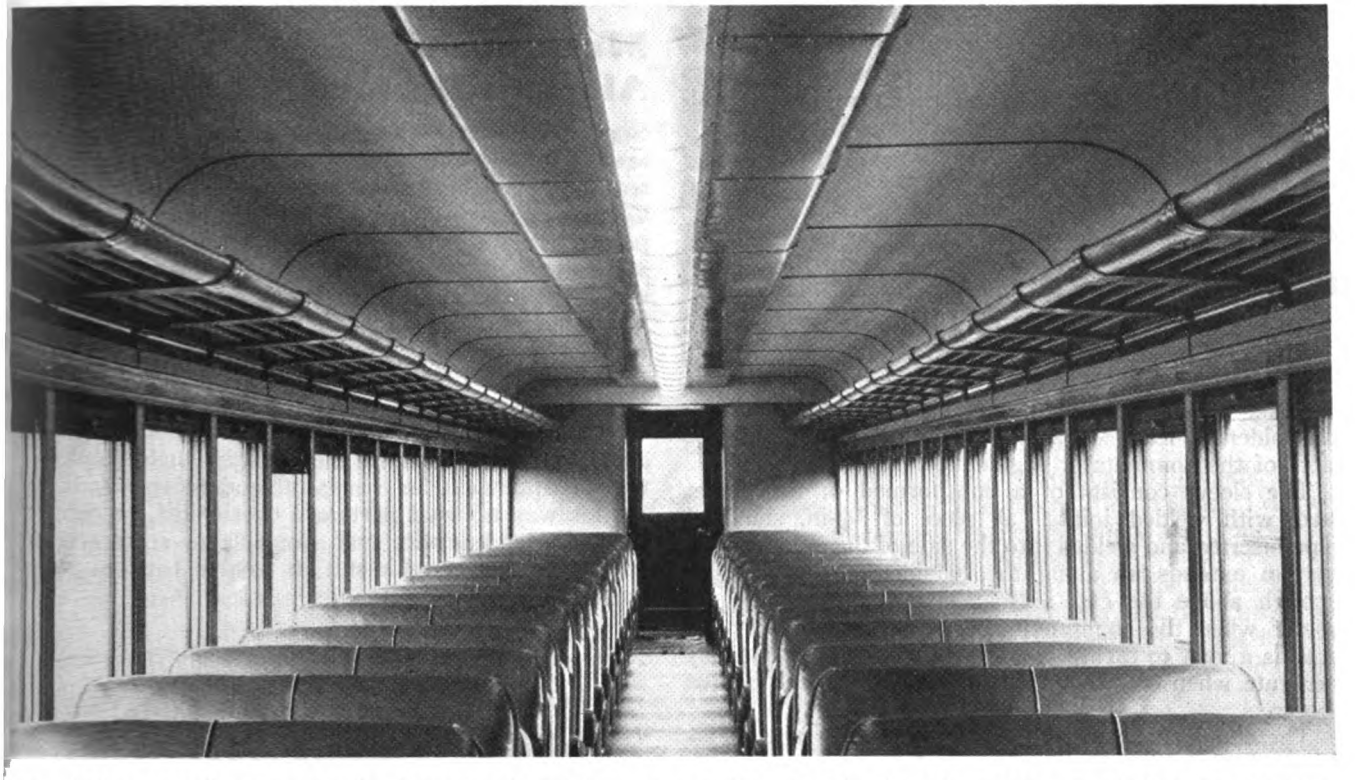


T-shaped holder in which the tool is set at an angle

holder; the bottom set screw on the tool bit in the slot.

Any angle desired may be milled in the holder and some operators prefer the tool bit slots on both sides to permit the use of the tool for both turning and boring. These holders are hardened before use.

ELECTRICAL SECTION . .



Uniform brightness of the central lighting fixture is effected by overlapping the ends of the 48-in. fluorescent lamps which produce the light

Continuous Fluorescent Lighting

The Chicago, South Shore & South Bend is now in the process of rebuilding ten coaches equipped with continuous fluorescent lighting. The continuous trough fixture which forms a part of the ventilating duct is located in the center of the car ceiling and extends the full length of the body of the car. The lighting units in this trough are 48-in., 40-watt, 3,500-deg. white fluorescent lamps. There are a total of 16 such lamps in each car and each lamp is placed at a slight angle to the center line of the car, providing a slight overlapping of units. This avoids dark streaks and renders the unit of uniform brilliance. The lamps are placed in an inverted trough and are covered with diffusing plastic shields, made in sections, which can be applied and removed from the trough by springing them into place. No screws, clamps or mounting bezels are required. Lighting on the 45-deg., 33-in. plane ranges from 15 to 20 footcandles.

Power for lighting is supplied by a motor alternator which converts the 32-volt d.c. power on the car to 110 volts at 60 cycles. Both the motor alternator and the lighting equipment were supplied by the Safety Car Heating & Lighting Company.

In addition to the lighting units, the interior of the cars has been completely redesigned. The ceilings have been lowered and new linoleum treatment applied to the end bulkheads, window posts, etc. In addition, the cars have been equipped with a forced ventilating system, which delivers air at the rate of 2,200 cu. ft. per min. to the interior of the car through continuous ducts on either side of the lighting system cowling. The cars are operated singly and in multiple-unit trains from an overhead 1,500-volt d.c. contact system.

Future Electric Transportation

An engineer in the transportation department of one of our large electric manufacturing companies recently received the following inquiry: "Will you please let me know why you don't make an electric auto? You used to make them years ago. I don't see why you couldn't make a coupe that would run 100 miles with one charging and have the batteries made so they could be charged in ten minutes in any service station. If you don't do it, I think Russia will after the war."

To this, he replied in substance as follows: "The American public, in its quest for speed and convenience, long since abandoned the electric automobile. It was too expensive and limited in scope. Until we can explode the atom, or put electrolysis in reverse, the development of a battery-operated coupe will have to be left to the victorious Russians.

"The American public, however, will enjoy greatly improved electric transportation in other forms after the war is won. Although out-maneuvered on small pleasure vehicles, electric propulsion has no equal for railroad and transit use! Aggressively developed and courageously applied, it will afford almost unbelievable speed, comfort and economy!

"Coast-to-coast passenger runs in less than twenty-four

hours are quite possible. Hundred-mile-an-hour freight at one cent a ton-mile needn't be far away. Speedy, convenient, city transit without traffic jams is simply a matter of planning and co-operation. The pleasing part is that these greatly improved services will cost the individual far less in time, money and effort than comparable service with any other private vehicle.

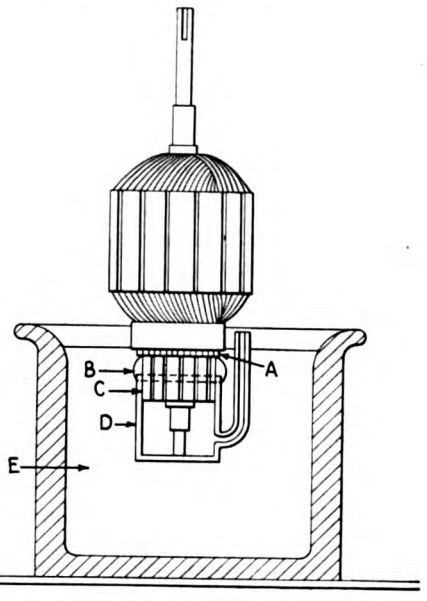
"Modern mass production has been America's successful formula for more goods for more people at less costs. We believe that the same formula can bring equally startling benefits in the transportation field."

Sleeve For Dip-Soldering

A protective sleeve devised by Donald Butter, a plant engineer at General Electric's Schenectady, N. Y., works, prevents molten solder from spattering on the operator or adhering to the body of the commutator or shaft when dip-soldering leads of small generator rotors into the slots of the commutator segments.

The sleeve consists of a cup formed of thin sheet steel with welded joints. A piece of ¼-in. standard pipe inserted and welded into the side of the cup near the bottom extends up along the outside to a point high enough above the cup so that it protrudes above the solder when the commutator is submerged. The pipe acts as a vent to carry off any steam or vapor that may generate when cold metal is submerged into the molten solder.

The cup is made with a slide fit so that it may be assembled on the commutator snugly, but without bending. It covers the shaft end and about three-quarters of the commutator body. The joint between the commutator body and the cup is taped, sealing it to prevent the entrance of molten solder. The entire rotor is suspended in a vertical position, with the commutator down, on an electric hoist directly over the solder pot. The commutator end with sleeve assembled is completely submerged in molten solder, covering the slots and lead ends. The rotor is left in this position until the leads are thoroughly sweat into the slots, then it is hoisted. The sleeve is easily removed with asbestos gloves, and the rotor is placed on a table to cool.



A: Commutator leads to be soldered—*B:* Friction Tape Seal— *C:* Commutator—*D:* Protecting Sleeve—*E:* Solder.

Protective sleeve for dip-soldering prevents spatter and keeps solder where it belongs

Maintaining Air-Conditioned Cars

Supervisors charged with the care of air-conditioned cars are being assisted in their work by wall charts and maintenance check lists furnished by the B. F. Sturtevant Company, Boston, Mass. The wall charts list the major points which must be taken care of in both mechanical and water-ice systems on air-conditioned cars. The nature of each operation required is indicated on the charts and the period within which these operations must be performed is stated together with the proper method of checking for repair. The maintainer's check list which is illustrated provides space for the indication of the workman's initials and the date on which each operation listed was performed. As the workman makes his inspection of equipment he checks off and records each item. In this way no vital parts are overlooked, procedure is simplified and service men are able to correct various conditions that could result in trouble between general overhaul periods.



Sturtevant service tag reminds service men of inspections and simplifies procedure when attached directly to each air-conditioning u

WELL—WELL

By
Walt Wyre

WHEN one of the best wells at the S. P. & W. roundhouse in Plainville started failing, the divison engineer wasn't much worried about water. He figured that the railroad could, as they had in the past, buy plenty of water from the city. When he received notice from the superintendent of the Plainville Power & Light Company that because of increased demand the city could only supply the railroad with a very limited amount of water, then the division engineer was worried and he began immediately to do something about it. Fortunately, a competent driller with good equipment that could start drilling almost immediately was found.

Ned Sparks, electrician for the railroad at Plainville, noticed the steel derrick and inquired about it, but gave it no more thought until about ten days later when Jim Evans, roundhouse foreman, told Sparks that the well was completed and that the division engineer wanted a motor connected the next day to operate a pump to test the well.

"Where is the motor and what kind is it?" Sparks asked.

"I don't know," Evans replied. "The divison engineer said to see the driller. He will show you what is to be done."

Sparks finished the job he was doing, soldering a lead on a dynamo field coil, and walked to the new well. The division engineer and master mechanic were talking to the driller when Sparks arrived.

"Here's the electrician now," the master mechanic commented.

"O. K.," the driller said. "The men are putting the pump in now. The motor is over on the other side of the derrick." The driller started around to the place indicated; Sparks went with him.

"Here it is," the driller said. "The starter is in that crate." He pointed at the crate.

"Looks like it might have been lost off a car loaded with scrap iron," Sparks commented as he stooped to examine the motor.

"Yes, it is pretty old," the driller admitted, but it runs goods. We just use the pump and motor for bringing in and testing new wells."

"It's a 220-volt motor," Sparks said.

"That's right," the driller replied. "Don't you have 220-volt current here?"

"No, all our three-phase power circuits are 440 volts," Sparks told him.

The driller walked around to where the division engineer and master mechanic stood and told them the situation.

"Well, isn't there anything you can do about it?" H. H. Carter, the master mechanic, asked Sparks. "Haven't we got a motor around here that could be used?"

"Bo," Sparks told him, "that is a vertical motor 3600 r.p.m., we don't have anything that could be used."

"Well, it looks like we will have to postpone testing the well until we can get a motor," the driller said. "How long before your new pump and motor will be here?" he asked the division engineer.

"About two weeks," the division engineer replied, then turned to Sparks and asked. "How far would you have to run a line to get 220 volts?"

"About a mile," Sparks said, "and we don't have the wire," he added.

"I sure wanted to get the well tested and move to Sanford and get started on the well there," the driller said.

"Yes, and I wanted to be sure this well will be O. K. when the pump gets here," the division engineer said.

Sparks started to walk away then stopped and said, "It's possible I might be able to connect the winding for 440 volts."

"How long will it take?" Carter asked quickly.

"Oh, about four or five hours, I'd say, but I'd have to have the motor in the electric shop. Of course, it's possible it can't be connected for 440."

"How long will it take to find out?" the driller asked.

"Not long. I'll have to take the end bells off."

"I'm going to the office," Carter said. "I'll tell the storekeeper to send his truck and haul the motor to the electric shop."

WHEN the motor was in the electric shop, it was a matter of just a few minutes to remove the end bells. One look and Sparks wished that he had kept his mouth shut. The motor was connected parallel delta and could therefore be changed to series delta for 440 volts, but the motor had evidently been rewound at some time in a shade-tree electric shop. There was no phase nor pole group insulation and the pole connections appeared to have been playing hide-and-seek and each tried to surprise the others by coming out at the least expected place. In addition the insulation was dry and brittle and would stand very little handling.

While Sparks was examining the winding, the driller and division engineer came in. "How are you coming?" the driller asked. "Are you going to make it?"

"Well, I believe so," Sparks said, "but what about the controller, is it 220 volts also?"

"It doesn't matter," the driller said. "It's just an old style hand controller and the transformer in it is burned out anyway. What voltage do you have at Sanford?" he asked suddenly.

"Two hundred and twenty volts," Sparks replied. "Why?"

"Because," the driller said, "we will want to use the pump and motor to test a well there in two weeks or less."

Then Sparks did wish he had been listening instead of talking when he mentioned reconnecting the motor. He raised up from the motor, scratched his head and said, "I'll be lucky if I get the job done this time without damaging the winding or breaking off a wire right up next to a coil."

"Most of the new motors we get have the wires brought out so they can be connected for either 220 or 440," the division engineer suggested.

"It sure would be fine if you could fix this one that way," the driller suggested.

"O. K.," Sparks agreed with disgust dripping from his voice. "I'll see what I can do."

THE two men left and Sparks went to work cutting coil connections and lifting up the leads. He rigged up a series test light to use in locating which lead went where and even then, because of the haphazard arrangements, had trouble keeping the wires straight. When he had the leads cut and leads straightened out he began to search for some wire to use for reconnecting. He found a piece of four-wire flexible cable about five feet long and stripped the outer covering off, which left four rubber covered number eight wires of different colors.

That gave Sparks the idea of using a different color for each phase which helped a lot when he started identifying and numbering the nine wires to be brought out so connections could be made for 220 or 440 volts without dismantling the motor. After the leads were connected, he soldered lugs on the wires and stenciled numbers one to nine on the lugs. Then he made a diagram on a brass plate showing connections for both voltages. The wires were numbered according to the delta diagram commonly used—1, 4, and 7 on red wires were one phase: 2, 5 and 8 on white wires were another phase; and 3, 6, and 9 on green wires (there weren't any blues) were the third phase. When connected 440 —1, 2, and 3 were line wires; 4 and 7, 5 and 8, 6 and 9 were connected together to give series-delta connection. For 220 volts, parallel delta, 1, 7 and 6; 2, 8 and 4; and 3, 9 and 5 were to be connected together and line wires connected to each set of three wires.

The haphazard winding and lack of practice by Sparks gave the electrician quite a headache before the job was finished, but the job was finally finished and the motor assembled ready for a test. Sparks wasn't any too sure the job was done correctly until he had connected the motor to a 440 line and tried it. He was well pleased and somewhat surprised when it ran O. K.

Next morning the motor was hauled to the well and installed on the pump. The driller complimented Sparks profusely and gave him a big fat cigar. If the electrician hadn't smoked the cigar before the well was finished at Sanford, chances are the driller would have taken it back.

After the motor was connected with a temporary line, Sparks started it, found rotation correct, and left it running. In just a moment muddy water began to flow from the discharge pipe. Sparks stood and watched while the drilling crew argued about how long it would take the water to "clear up."



Two compliments in two days are just about as much as an ordinary railroad electrician can stand

While he was watching and listening, the roundhouse foreman came up to the well and stopped beside Sparks. After watching a moment the foreman said to Sparks, "We almost have to have some lights underneath the overhead crane in the machine shop. You remember I spoke to you about it over a month ago."

"That's right," Sparks agreed. "I ordered a 500-watt transformer to step the voltage down from 440 to 110, and it looks like a long time before we will get it."

"Now that we are working three full shifts in the machine shop we sure need lights under the crane. Every time it is stopped it cuts the light off from over one or more machines," Evans said. "See if you can't fix up some temporary lights until we get the transformer."

SPARKS' first idea about the lights was four in series across the 440-volt line, but he didn't like that for several reasons. The first reason was that someone might get a good healthy jolt fooling with lights connected that way and the next reason was if one light burned out none would burn and it would be a nuisance locating the one that was burned out.

He had a 440-volt to 220-volt transformer in the shop and decided to compromise and use that with two lights in series. It was a 500-watt transformer which would allow one 200-watt lamp near each end of the crane.

Sparks finished the job next day. The weather was what Californians would call "unusual" if it had been there. Clouds hovering low over the machine shop made it so dark inside that shadows cast by overhead lights were almost as clearly defined as at midnight. When the wiring was finished, Sparks turned the switch. A machinist working at a lathe under one of the lights looked up suddenly and nodded his approval and grinned. Sparks grinned back at the machinist and began to gather up his tools. Evans came into the machine shop and noticed the lights at once. "Good job," the foreman said to Sparks, "just what we have been needing for some time."

Sparks went to the electric shop carrying an arm load of tools and a much inflated ego. Two compliments in two days is just about as much as an ordinary railroad electrician can stand, but next morning the master mechanic had his deflater ready when Sparks came to work. He was waiting in the office when Sparks got his card.

"THE fuel oil pump motor wouldn't shut off last night and the hostler ran about five or six hundred gallons of oil on top of the tank of the 5098." The master mechanic's voice was rough enough to shell corn.

"Quite a mess, I imagine," Sparks commented.

"Yes, but that's not all of it," Carter said. "The Limited came along about an hour later and tried for twenty-five minutes to get oil at the main line crane before they found out the main switch to the fuel pump motor was pulled. Then the motor wouldn't shut off and they ran the tank over on that engine too. Find the trouble right away and let me know and fix it so it won't happen again."

It didn't take long to find out why the fuel oil pump motor wouldn't shut off. Some one when pulling the crane around to take oil had hung the hook in the flexible wire that connected the conduit on either side of the ball joint and shorted the two control wires to the switch on the crane. Sparks corrected the trouble, then went to the office and told the master mechanic what had caused the trouble.

"Seems like there should be some way for a man on an engine at the oil cranes to tell when the motor is running. Can't you fix up an indicator light that will show when the switch is on?" Carter asked.

"Yes, I suppose so," Sparks replied. "Where could I put it so it could be seen from all four cranes?"

"Put it on a pole, or any place where it can be seen," the master mechanic suggested. "I'll go up there after a while and see where to put a light."

Sparks left the office and went to the fuel pump motor to figure how the job of installing an indicator light was to be done. As two-wire control was used on the cranes there was a pair of contactors in the controller not being used. They would serve nicely to turn the light on when the controller contactors were closed and turn the light off when the contactors were open.

"Got it all figured out?" Sparks, busy examining the controller, didn't know the master mechanic was around until he spoke.

"Everything except where to put the light." Sparks closed the door of the controller and straightened up.

"Why not put it on that dog house on top of the water tank at the treating plant?" Carter suggested.

"It could be seen O. K.," Sparks admitted reluctantly. What he thought was, *it's a hell of a long way up there and the tank is too big to put a safety belt around.*

At any rate, Sparks and a helper started to run the line. First trip to the top of the tank the helper started up the ladder like a fireman going up to rescue a pretty girl from a second story bedroom. About half way up the helper stopped all out of breath and Sparks coming up slowly behind overtook the helper.

"What's the matter?" Sparks asked.

"This thing didn't look so tall from the ground," the helper said, "and this hundred foot hand line wasn't heavy when I started."

"Yeah, I didn't think you could keep going at the rate you started," Sparks said. "Now just pretend you are on the ground and start over."

"Wish I was on the ground," the helper complained. "Do you suppose there is any danger of this ladder breaking?"

"If it breaks, I'll turn in a safety card on it," Sparks replied.

It was a mean job installing the light on top of the dog house, but it was completed next day. A blue globe was placed over the 75-watt lamp and it showed up well, particularly at night. The master mechanic was so well pleased with the job that he almost forgot about the spilled oil on the engine tanks and delay to the Limited.

EVERYTHING went along about normal for the balance of the week, with nothing unusual happening. Monday morning there was a wire from the division engineer saying that the well at Sanford would be finished Tuesday and for the electrician to bring wire and other necessary material to connect the motor for testing the well.

The division engineer had previously told Sparks where the well was to be located and the best the electrician remembered it was only about one hundred feet from a three-phase power line. He found about three hundred feet of number six weatherproof wire which he shipped along with about thirty feet of four-wire cable. He arrived in Sanford Monday night.

Tuesday morning Sparks went to the derrick which was not where he had expected it to be. "They decided to change locations," the driller explained.

"Well, I am going to have to have some more wire," Sparks said. "It's over three hundred feet to the nearest power line."

"There are some rolls of wire in the water service shop," the driller said. "I saw them yesterday."

There was some wire, about 800 feet of number 10 rubber covered and that was all the wire to be found anywhere around. Sparks knew the number 10 wire was too small for the 15-horsepower 220-volt motor, but it was all he had. He ran the number 6 as far as it would go, then finished with the smaller wire. He swung the wire on telephone poles that happened to be in the right place. By the time Sparks had finished running the line, the drilling crew had the motor in place ready to connect and it was time to go to lunch.

After lunch Sparks connected the wires to the motor being careful to get the correct numbered lugs together on the motor leads, 1-7-6; 2-8-4; 3-9-5.

"Ready to try it?" Sparks asked.

"O. K.," the driller said.

Sparks shoved the handle of the antiquated controller. The motor buzzed loudly and slowly started turning in the wrong direction. Sparks switched two line wires and closed the controller again. The motor again buzzed loudly and started rotating in the right direction, but slowly. Gradually, too gradually, the motor accelerated until it reached about half speed then accelerated no more. In about two minutes the motor winding started to smoke and Sparks pulled the controller handle to "off."

"Acts like low voltage," the driller suggested.

"I knew that number ten wire was too small," Sparks scratched his head as he spoke, "but I thought it would at least run O. K." Sparks examined the motor connections to be sure they were correct, tested to be certain there wasn't an open in one phase of the line, then tried the motor again. It acted the same as before.

"Looks like we need larger wire," Sparks said.

"Where can you get it?" the driller asked.

"Plainville is the nearest place and I'm not certain about having enough there. I'll have to go get it because I'll have to gather up odds and ends from half a dozen places."

"Well, I'll send one of my men with the pick up to take you, then you can get back before noon tomorrow," the driller offered.

"O. K.," Sparks said, "and believe I'll take the motor and test it, just to make certain there's nothing wrong with it."

IT was two o'clock when Sparks left Sanford. The driver watched the speedometer, sticking pretty close to thirty-five miles an hour. They reached Plainville about five-fifteen.

"Where do you want the motor?" the driver of the pickup asked.

"Let's leave it at the electric shop," Sparks said. "I'll get the portable crane to unload it."

Sparks went into the machine shop looking for the crane. Jim Evans who was in the shop at the time came rushing up to the electrician. "Say, those lights you put in underneath the overhead crane have got a short in them or something," Evans said.

"Won't they burn?" Sparks asked.

"No, the one on the north side burns out bulbs fast as they are screwed in the socket."

"I'll look at it soon as I unload a motor that's outside by the electric shop in a pickup," Sparks told the foreman.

"What time will you be ready to start in the morning?" the driver asked after the motor was unloaded.

"Maybe we had better start about seven o'clock," Sparks suggested.

"O. K.," the driver agreed and drove away.

Sparks picked up a 200-watt lamp and went back to the machine shop. There was a 200-watt lamp in the south socket. Sparks screwed the bulb in the other socket and turned the switch. The lights were O. K.

"That's peculiar," Evans said. "They burned out half a dozen bulbs in that socket last night. Some of them are over there on the bench."

"Why, those are 100-watt lamps," Sparks exclaimed.

"That's right," Evans said. "We didn't need so much light on the north side and I told them to use a smaller bulb in that socket."

Sparks explained how that when burned in series it was necessary for all lamps to be the same, then went to eat.

After supper Sparks returned to the roundhouse and started looking for wire. There wasn't any larger than number 8 to be found and only about 250 feet of that. There was a 500-foot roll of number 10. He decided to use that and parallel it with the number 10 lines already up. That done he went to the electric shop and started testing the motor. It tested O. K., but he still had a premonition it wasn't exactly right.

After debating the question with himself he got the portable crane and hauled the motor to the transformer bank and connected it to the 220 line. The motor behaved exactly as it had in Sanford. He decided that maybe the six and nine were switched and swapped them. The motor behaved as before only more so. Then he hauled the motor back to the electric shop and removed the end bells.

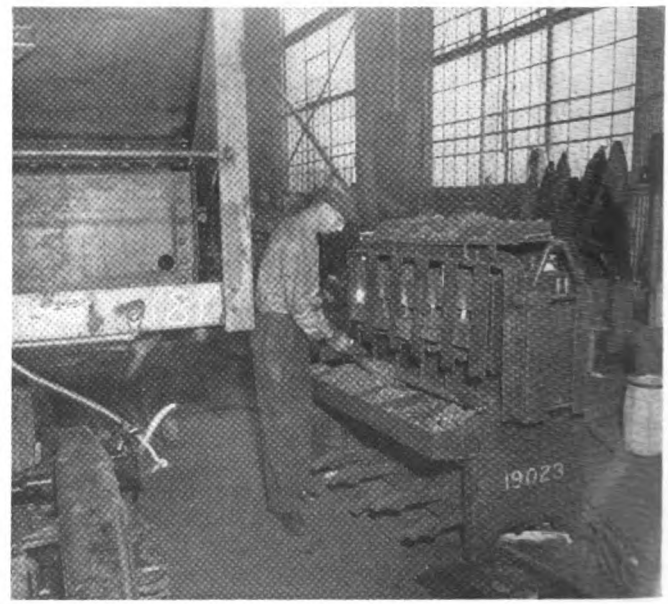
It was almost midnight when he found why the motor wouldn't run. Number eight and number five on the motor leads were transposed. It didn't make any difference when the motor was operated on 440 volts because the two were connected together, but when connected for 220 volts, one-half of one phase was connected to oppose the balance of the winding. Sparks swore, switched the lugs and reassembled the motor.

Next day after increasing the copper of the line to the motor by paralleling the wires, the motor ran O. K.

Sparks still wonders if the motor would have run and carried the load without the additional wires.

What do you think?

* * *



Berwick electric rivet heater in operation at the Huntington, W. Va., plant of the American Car and Foundry Company

Long Life for Evaporators and Condensers

What can I do to get the best service and longest life from the evaporator and condensers in our air-conditioned cars?

The More Repairs The Shorter the Life

Most evaporators and condensers of present air-conditioned railway cars are constructed of tinned copper tubing with brass end plates, etc. This construction resists corrosion and provides for long life. Air conditioning equipment must contend with the arch enemy of all electrical apparatus, General Dirt and his lieutenants, lint, pollen, dust, moisture, grease and oil.

The evaporator in the refrigeration cycle of an air-conditioning system is that portion of the apparatus in which the refrigerant is evaporated or changed from a liquid to a gas. The heat removed from the air flows through the fins and tubes of the cooling coil or evaporator and into the refrigerant contained therein. The heat causes the refrigerant to change from a liquid to a gas and the amount of heat absorbed depends on a number of factors including: (1) the latent heat of evaporation of the refrigerant; (2) the average temperature of the refrigerant within the evaporator; (3) the dry bulb and wet bulb temperatures of the entering air; (4) the amount of air passing over the evaporator; and (5) the thermal conductivity of the tubing and fins.

When a report is received from the conductor that a car is not cooling properly, inspection shows too often that it is caused by a dirty or stopped-up evaporator. This will cause low suction pressure for which dry, dirty filters or poor maintenance may be responsible.

The condenser, with its copper tubes and copper fins fastened to the tubes to increase the radiation, is that portion of the apparatus in which the refrigerant is condensed or changed from a gas to a liquid. In other words, the heat absorbed by the evaporator is dissipated by the condenser into the cooling medium air or water. Sufficient heat must be removed to condense the gas into a liquid, and clean condensers are essential. Very dirty or stopped-up condensers, especially on hot days in the summer, will cause high head pressure and cause the high pressure switch to cut the compressor on and off, resulting in another air-conditioning failure.

With the shortage of experienced electricians in railroad air-conditioning maintenance, it is essential that some plan be formed or outlined to maintain air-conditioning equipment properly. To get more efficient and better service as well as longer life from the evaporators and condensers, I would suggest the following procedure for cleaning evaporators and condensers: First, make an inspection when an evaporator is due for cleaning, say twice a year. (A.C. card shows last date cleaned, by whom and where, etc.) Make sure all bolts and piping are tight and secure, to eliminate loose connections on evaporator or condenser which would cause a Freon leak. Soldering and other repairs should be avoided as much as possible. The more repairs you make to evaporators and condensers the shorter their life will be.

For cleaning, we use an iron tank mounted on wheels, like a battery flushing cart, which holds about 40 gals. This we fill about three-quarters full of clean water and add one pint of soda ash or two pints of Oakite. The solution is then heated from a steam hose until it boils. An air connection at the top of the tank allows for connection with an air line. The air pressure forces the solution up to the washing nozzle. Cleaning nozzles are made of pipe tees. These nozzles are bent in various shapes to permit getting at the evaporators from all angles. Air and water lines are brought into the cleaning nozzle with valves to adjust the rate of flow of both air and cleaning solution. The outlet is a small drilled hole.

After the fronts of coils are washed by a slow movement of the nozzles held close to the evaporator, the covers are removed and the evaporator is washed from the back through the plenum chamber. The tank is then filled with clean water and the evaporator coils are thoroughly rinsed. Care must be exercised not to get solution into the ducts or on seats inside of the car as it will spot upholstery, remove paint, etc. We cover seats with a canvas. When the washing is started, be sure the solution or compound is running out freely to ground so there is no danger of the drain pan overflowing and damaging the interior of the car. After coils are washed properly they look like new and are good for another six months. We clean in the spring and in the fall at the start of the cooling and heating seasons, respectively.

Condenser coils can be cleaned the same way, and between times, they may be blown out with air and washed with water. Most condensers are equipped with a screen to keep rocks and sticks from bending the fins or striking the coils. We add a second heavy screen about 24 in. from the first screen. This gives an added protection and we find it keeps the condenser in better shape, thereby increasing its life.

V. W. WHITE,
Electrician,
Illinois Central.

Can you answer one or more of the following listed questions? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York, N. Y.

What suggestions can you make for getting best performance out of air-conditioning filters, particularly with reference to present-day operating conditions?

How can I tell when a capacitor is not operating properly?

Proper Cleaning and Thorough Rinsing Insures Longevity

The primary function of the evaporator and condensers of the air-conditioning apparatus is heat transfer, the capacity and efficiency of which is based upon service with a clean metallic surface. The evaporator is subjected to a coating for foreign matter (carried in both the fresh and recirculated air) of such density and mass that these particles pass through the air filters and are deposited upon the tubes and fins of the evaporator.

The condensate on the evaporator carries off some of

this foreign matter but a certain amount remains and, in proportion to the service period, a coating is built up on the fins to a thickness which eventually will completely seal the open spaces between the fins. The worst condition will be found on the entering face of the evaporator. This conglomeration of foreign matter consists of lint, coal dust ash, and condensed liquids from human body evaporation which will cause corrosion of the metal in the evaporator and pollution of the air with odors.

The evaporator should be cleaned periodically with a hot alkaline solution. The wash solution should be made up of 5 gal. of hot water at approximately 180 deg. F. and 4 to 5 oz. of Oakite Penetrant, or No. 20 Wyandote Cleaner, or Cowles C. C. Cleaner. The washing solution should be applied with a lift type steam pressure gun. One half of the five-gallon solution should be applied to each face of the evaporator. It is necessary and important that metallic shields be put in place over the face of the evaporator opposite the side being washed for protection of the plenum chamber and painted surfaces, because this hot alkaline solution will injure paint.

After washing with the prepared solution the evaporator must be thoroughly rinsed with approximately 5 gal. of hot water. Particular care must be taken to assure a thorough rinsing of the evaporator and heating radiator because the alkaline solution will have an injurious effect if allowed to remain in contact with either aluminum or tinned copper fins.

The frequency with which the evaporator must be washed depends upon type of service and operating conditions. It is more satisfactory to include this washing of the evaporator with other periodically assigned work to insure regular attention.

The condensers operate under a different condition of encrustations on the fins and tubing by reason of the difference in temperatures and foreign matter in the cooling air. They are subjected to all sorts of dust and dirt common to railroad operation. The worst and most injurious element is an accumulation of coal dust and cinders in the spaces between the fins and tubing, particularly at the bottom section of the condensers. By reason of the higher temperature of the refrigerant gas inside the condenser as compared to the ambient temperature of condenser air, foreign matter is literally baked onto the condenser surface.

To maintain full efficiency and reduce corrosive action on the condensers, two methods of condenser cleaning are recommended. For periodic attention during the cooling season, the interior of the compressor or condenser box should be thoroughly cleaned by brushing or with an air jet. The condensers at the same time should be flushed with water from a hose for removal of all coal dust and other foreign matter from the lower section of the condenser. In this operation the compressor motor must be covered with canvas or some water-proof fabric for protection against moisture. The frequency of this cleaning is governed by the operating conditions as indicated by the condition of the condensers.

At the time of shopping of the air-conditioning apparatus or at other periods not greater than every two years, the condensers should be given a thorough cleansing with an acid solution. For this cleaning the compressor motor should be removed from the condenser unit and the bottom pan and baffle plates at the discharge side of condensers should also be removed to provide access for thorough cleaning.

An acid solution may be made up of 5 gal. of water with 3 qts. of commercial muriatic acid or 20 lb. of Oakite No. 32 chemical. This solution, totalling approximately 6½ gal., should be used on each condenser and applied with the same type of steam-operated, lift-type pressure gun as used for cleaning the evaporator. Half of the solution should be applied on each side of the condenser. After thorough cleaning of each condenser, it must be thoroughly rinsed with at least 5 gal. of warm water, using the same steam-operated pressure gun for this operation. If aluminum fins are used in a condenser, the solutions for evaporators should be used.

After complete cleaning of the condensers a thorough inspection should be made for condition of fins and tubing. Fins should be straightened if necessary. The condition of return bends and tube supports in end sheets should be carefully inspected for possible damage caused by expansion of the tubes.

AIR-CONDITIONING ENGINEER.

Testing of Oxide Film Rectifiers

What is the best and easiest way to find whether an oxide-film rectifier is shorted or operating properly?

Rectifier May Be Treated as a Resistance

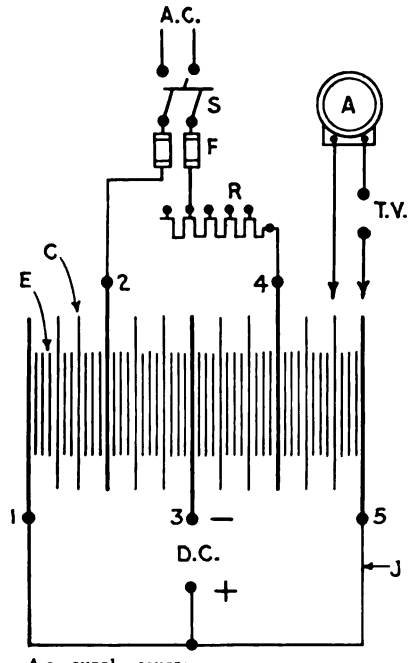
The oxide-film rectifier consists of copper disc elements on which a film of copper oxide has been formed by heating. It is essentially a resistance device which offers low resistance to current flow in one direction and a resistance of 1,000 to 10,000 times greater in the opposite direction. Evidently, when an alternating voltage is impressed across a set of plates, more current flows from the copper oxide on one face to the copper on the other face than in the opposite direction. This characteristic meets the requirements of a rectifier. The resistance of an oxide-film rectifier varies with the number of discs in parallel or in series, the age, the service history and the ambient and operating temperatures. A suitable resistance is connected in series on the a.c. side to obtain the required d.c. voltage on the output side.

The condition of an oxide-film rectifier may be determined by treating it as a resistance device and applying a volt-ampere test. Outside of a suitable source of d.c. voltage, which may consist of a few dry cells, the instruments required for the test are an ammeter, a suitable voltmeter and a milliammeter. A switch and a pair of low rating fuses should be used in connecting the rectifier to the a.c. circuit in measuring the no-load output voltage after the individual elements have tested clear.

A d.c. test voltage of 1¼ volts per disc applied in the rectifying direction should result in a current of the order of 1 ampere, this value depending on the history of the disc and the ambient temperature at the time of the test. A d.c. test voltage of about 6 volts per disc of 1½ in. diameter, applied in a direction opposing the direction of rectification, should allow the passage of a current of the order of 10 milliamperes, also depending on the condition and the temperature of the discs. The current values given are for an ambient temperature of 70 deg. F. It is advisable to test each section of discs separately. The cooling fins which are larger in area and protrude through the sections of discs provide a convenient access for step-by-step test measurements. If the temporary removal of all the interconnections presents considerable difficulty, a less conclusive test may be made by remov-

ing the jumper between the two positive terminals, sectionalizing as many rectifying units as at first readily accessible and applying the proper test voltage across the two d.c. terminals of each group.

If part or all of a rectifier unit has failed, the current flowing in the opposite direction of rectification will be much higher than specified. In view of this possibility, the test voltage should be gradually built up to six volts per disc to avoid damage to the milliammeter. When



A.C.—A.c. supply source
S—Double pole switch
F—Fuses
R—Series resistor
2 and 4—A.c. supply terminals
3—Negative terminal
1 and 5—Positive terminals
C—Cooling fins
E—Elements, each consisting of a copper disc, coated with a film of copper oxide on one side and a soft metal disc making contact with this oxide at a predetermined pressure
TV—Test voltage: dry cells
A—Milliammeter
J—Jumper to be removed before testing
D.C.—D.c. output

Cross section of a full-wave, single-phase rectifier showing how a milliameter is used for testing

a defective element in a full wave rectifier unit is not detected and replaced in time, either one or both halves of the unit may break down and cause the a.c. fuse to blow. One unit of a rectifier, which may consist of as many units in parallel as the load current may require, is shown in the accompanying sketch. It is always safer to replace the whole unit even though only a section of it is found to be defective. However, during the present emergency where oxide-film rectifiers may not be readily available, an attempt can be made to assemble the good parts of defective units to replace a defective unit.

The life of a well-maintained rectifier is practically unlimited. However, a rectifier ages in service and its output voltage may drop as much as 20 per cent depending on the history and combination of discs used. Due to this aging characteristic, the series resistance on the a.c. side is provided with taps. As the output voltage decreases with aging, the a.c. terminal voltage of the rectifier is raised by reducing the voltage drop across the resistor. The d.c. operating voltage is thus kept within satisfactory limits for a long period of time.

Satisfactory operation can be secured by avoiding undue overloads, more frequent operation and of longer duration than prescribed, excessive ambient temperatures, insufficient ventilation and excessive applied voltage. Excessive moisture and the presence of corrosive fumes may also shorten the life of an oxide-film rectifier. Overfusing is another common error. The heat generated by a defective unit has often been found to be so intense as to damage adjacent units before the series resistor has burnt out and opened the circuit. In circuit-breaker application, the majority of failures result from the failure of the momentarily closing control relay to trip when the circuit-breaker is closed and the inability of the circuit-breaker to close due to too low an output voltage with the sustained effort of the operator to force the closing of the circuit-breaker by remote control.

R. G. CAZANJIAN,
Electrical Engineer,
Brooklyn, N. Y.

Resistance Must Be Low In One Direction Only

Copper oxide film type rectifiers as used in railway signaling for fluorescent car lighting and battery charging consist of copper oxide on the surface of copper disks. This combination acts as a valve and passes current through in only one direction.

The disks can be made in different sizes according to the current capacity desired and groups of disks can be bolted together in series or parallel to provide the proper voltage rating and current capacity.

In testing a dry-disk oxide-film rectifier for trouble, the quickest and easiest way is by using an ohmmeter or Megger. First connect the test leads of the ohmmeter across the terminals of the rectifier and note the reading. Then reverse the ohmmeter test leads and again note the reading. If the rectifier is in working condition the resistance should be several times as great on one test as it is on the other.

If both tests produce infinity the unit is open.

If both tests produce zero readings the unit is shorted.

V. W. WHITE,
Electrician,
Illinois Central.

Use An Ohmmeter

The easiest way to determine whether an oxide-film rectifier is shorted or operating properly is to test it with an ohmmeter. An ohmmeter as usually constructed consists of one or two flash-light cells connected in series with a variable resistance and a milliammeter. By replacing the scale of the milliammeter with a scale properly calibrated in ohms, it is possible to make this combination register the resistance of any unknown resistor.

The ohmmeter operates by passing a small amount of direct current through the unknown resistor. If we stop to think for a moment we will realize that an oxide-film rectifier which is in good condition will not allow current to flow through it in both directions. Therefore, its resistance to current flow must be different in one direction than in the other direction.

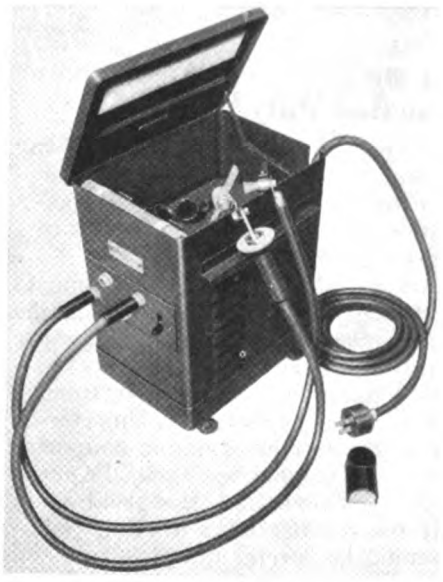
If we measure the resistance of an oxide-film rectifier in one direction, and then reverse the leads of the ohmmeter and measure the resistance of the rectifier in the opposite direction, we will find that there is a very large difference between the two readings. In fact, if the rectifier is in proper operating condition, the resistance in one direction will be found to be very high (approaching infinity), while the resistance in the other direction will be very low. If the rectifier has a short, the resistance in both directions will be low and of about the same value.

WM. BREWSTER
Electrical Engineer

NEW DEVICES

Conditioner For Metallizing

A Fuse-Bond Unit is now being offered by Metallizing Engineering Company, Inc., Long Island City, N. Y. which is used to prepare surfaces of metal parts for metallizing. The unit consists of a transformer mounted on casters which supplies current to a metal electrode. The electrodes fuse on the surface of the metal to form a multitude of irregularly shaped cavities, the result being a rough and porous anchoring surface. The work itself is not heated sufficiently to cause a change in its grain structure. The process eliminates the need of blasting or rough threading; and after the surface has been prepared the sprayed metal is applied as usual, with a gas flame.



Metal can be prepared for spraying at the rate of three to four square feet per hour

Joint Sealing and Anti-Seize Compound

A non-hardening and non-expanding joint sealing and anti-seize compound known as Bestolife lead seal No. 270, has been developed by the I. H. Grancell Company, 1601 East Nadeau street, Los Angeles, Calif. It contains a high percentage of finely powdered metallic lead, and is suitable for use on pipe joints, studs, staybolts and other screw thread fittings. It may be used on air, oil and steam-line connections under any operating temperature conditions. Joints, studs, and staybolts assembled with the compound can be broken out easily when necessary.

A Purifier for Diesel Engine Oil

A contact-filtration type purifier, developed by the Youngstown Miller Company, Inc., Sandusky, Ohio, is now being used on several railroads for reclaiming Diesel-engine crank-case oil. The particular unit illustrated is a Model A-75 which has a capacity to treat 75 gal. in 70 to 90 min. without presettling or pre-treatment of the crank-case oil. The unit occupies a floor space 79 in. by 56 in., is 89 in. high and weighs about 3,000 lb. Machines of this type are available in sizes from 8 to 200 gal. capacity.

The equipment includes a well-insulated open-ventilated heating tank with a 1-hp. electric-driven agitator shaft and propeller centrally mounted and dynamically balanced. A small blower fan mounted on this shaft just under the lid of the tank is used to remove vapor and gas which forms on top of the oil. A secondary transfer tank with conical bottom is piped to receive oil and clay mixture from the heating tank and deliver it under air pressure to a filter press from which clean oil is drawn for re-use in the Diesel engines.

The Chromalox heating elements, built into the tank walls, are designed to operate at low temperatures and are said to last the life of the machine. The heaters are turned on manually and turned off automatically by thermostats, this condition being indicated by a light on top of the machine. The agitator motor is manually controlled but interlocked so as to be always in operation when the heaters are on. The 1-hp. dirty-oil charging pump is started manually and stopped automatically by a float switch. The dual control thermostats are responsive to the tank wall temperatures and provide a degree of protection even if the heaters are turned on with the tank empty. They are set so that one thermostat, controlling half of the heating elements, will cut out about three minutes before the other to allow ample time for normalizing the temperatures of the heater zone before the oil is dropped out of the heating tank. A thermometer is installed to indicate temperatures in the oil heating tank.

The filter press is of the Y.M. two-stage plate and frame type, clean oil coming from the first stage and then passing through a second polishing stage before leaving the filter. The clean oil leaves the filter under sufficient pressure to return directly to the engines or to overhead storage tanks. The complete purifier forms a sturdy, compact unit, ready for installation and service without any special foundation or holding bolts. The machine is designed to use various common refinery earths available on the open market. Filter papers, supplied by the manufacturer, can be used over and over.

The purpose of this equipment is to remove non-lubricating volatiles from Diesel engine oil by slow heating, and solids and asphaltic material by filtering. It is capable of removing fuel dilution, water, acids, solid and colloidal carbon, dirt etc. Insofar as the contaminants are concerned, the

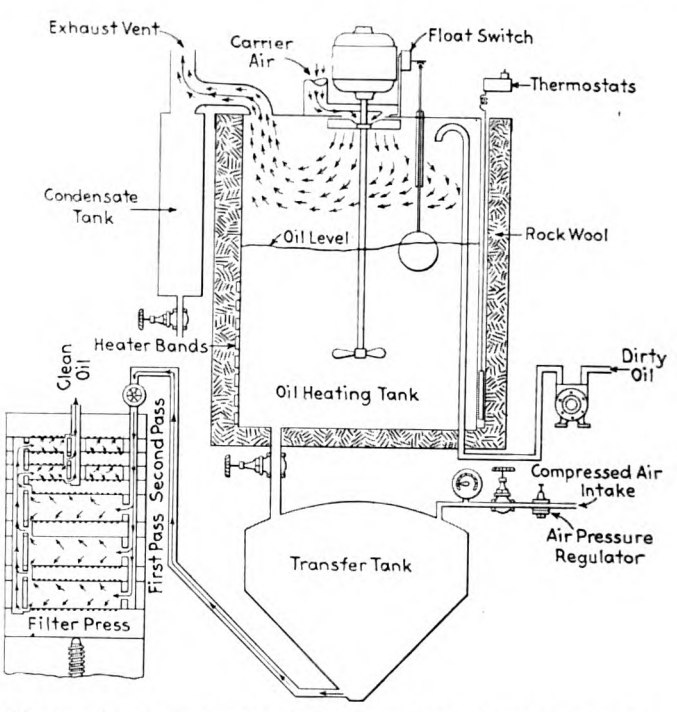
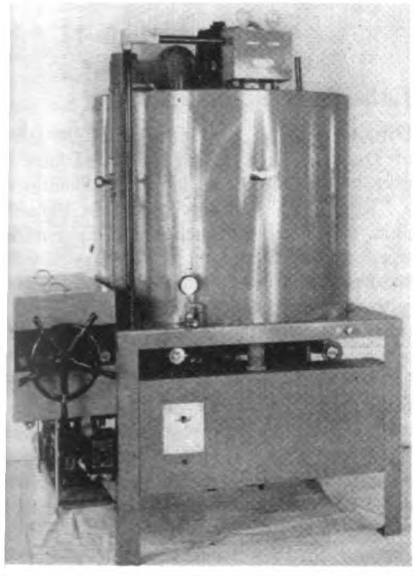


Diagram showing principal parts of the Y.M. Diesel engine oil purifying equipment

il is said to be restored for re-use to the quivalent of new oil, with acidity reduced) new low values and asphaltic materials ntirely removed. The quality of the clean il is said to be uniform from the beginning



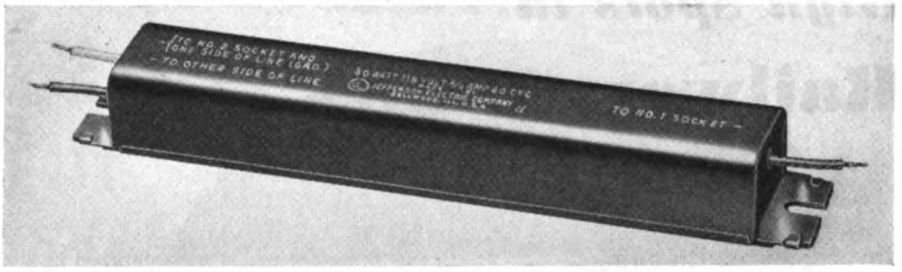
'oungstown Miller Model A-75 unit designed to purify Diesel engine crank case oil

) the end of each batch and from batch) batch.

The process for treating the oil is the ame in all models of Y.M. purifiers. The irty oil is pumped into the heating tank; filtering earth is added; and the oil is eated to evaporate the water and fuel ilution. The vertical motor-driven proeller keeps the oil and clay mixture in iolent agitation. The blower fan draws ir into the still to entrain the vapors as ıey come out of the oil and carry them to ıe exhaust vent. If this draft of carrier ir were not provided, the space above the il would soon become saturated with the apors and removal of the water and dilu- on would be incomplete. When the oil as been sufficiently heated, as determined y the signal light, it is filtered to separate from the dirty earth which entrains ums, sludge, solid particles of metal, dust, irt, etc., coloring matter and acids. The il is thus restored with full lubricating roperties, and is clear with a good color pproximately that of new oil.

Ballasts for Fluorescent Lamps

complete line of fluorescent lamp ballasts now being made by the Jefferson Elecic Co., Bellwood, Ill. The latest of these one to operate four 100-watt lamps. Two mps are operated in series (they start in quence) on each leg of the ballast cirit, the legs being lead and lag branches r power-factor correction and maximum imination of stroboscopic effect. This ethod of using fluorescent lamps increases ght output per watt by eight per cent and



High-power-factor two-, three-, and four-lamp ballasts reduce current and minimize stroboscopic effect

markedly reduces fixture weight. Fixture cost is reduced about 20 per cent and the ballast cost is about one-half that entailed with two-lamp units. The four-lamp circuit also saves about 50 per cent of critical materials required for making the ballasts.

Plastic Case on Portable Electric Drill

A portable electric drill of ¼-in. capacity which has a grip handle, field case and gear case constructed of a tough, light-weight plastic—Thorite—is being released for general sale by the Independent Pneumatic Tool Company, Chicago. This Thor drill



A plastic case makes this drill light and easy to handle

has been in production for a year but all output was required for previous commitments on military orders. Service performance is said to prove that power output per pound is greater, strength and protection from shock increased, and that the unit is cooler in operation than previously produced units.

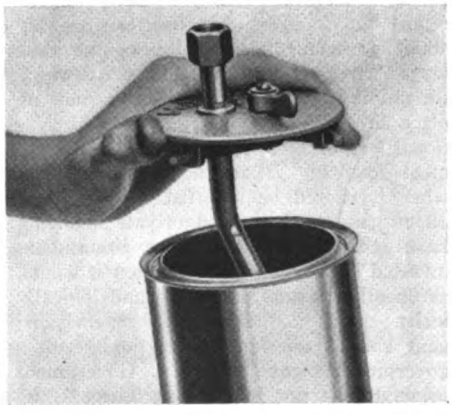
Eye Protection For Flame Welders

Development of a new eye-protection glass, Didymium-Noviweld, which permits the eyes of gas welders to pierce blinding glare and see welding operations from beginning to end, is a development of the American Optical Company, Southbridge, Mass. Lenses made of the new glass possess all the ray-absorptive properties of American Optical's Noviweld glass, plus the special characteristics of Didymium, a combination of elements with high absorption in that particular portion of the visible spectrum where "flux flare" normally obstructs clear vision.

In all types of flame welding, the new Didymium-Noviweld safety goggle lenses cut down the high-intensity sodium rays of the fluxes. Flame workers can thus look through the yellowish cloud of "flux-flare," see the rod and molten area more clearly, and thereby step up their efficiency in every phase of the welding operation, particularly the flame welding of aluminum and steel. The lenses also protect eyes by absorbing the harsh, tiring, invisible ultra-violet and infra-red rays generated during welding.

Paint Spraying From Original Cans

A recently developed clamp-type cover permits the use of original quart-size, friction-top paint containers in spray-painting operations. The cover fits standard type paint cans and it may be used in connection with most of the commonly used hand-spraying units. This top is also useful in permitting rapid changes from one color to another without the necessity of cleaning containers between changes. The cover unit can be cleaned and clamped on a can of different colored paint in a short time. The Master Manufacturing Company, Chicago, has introduced this cover.



A clamp-type cover for spraying equipment which fits any standard quart-size paint can

High Spots in
Railway Affairs . . .

Governmental Planning For the Post-War Period

The bureaucrats at Washington are busy doing everything they can to dig in and assure their future when peace comes. The country was amazed when, on March 10, the President sent to Congress the report of the National Resources Planning Board on "Security, Work and Relief Policies." At the same time he transmitted another report from the board, entitled, "National Resources Development Report for 1943." In its findings and recommendations on transportation the report contained this clause: "Transportation Modernization. We recommend: (1) A National Transportation Agency should be created to co-ordinate all Federal development activity in transportation, absorbing existing development agencies, and cooperating actively with regulatory agencies. The agency would be responsible for unifying government transportation planning, administrative and development functions, and would assume leadership in consolidation, co-ordination and reconstruction of transportation facilities and services." The report then went on with recommendations for public responsibility for basic transport facilities through terminal reconstruction and Federal credit for the provision of new facilities. In making recommendations for each media of transportation it included, among other items applying to the railroads, this statement: "Consolidation of railroads into a limited number of regional systems by legislation, with appropriate authority granted to the Transportation Agency to enable such a program to be carried out vigorously."

Re Government Ownership

The Transportation Association of America, Inc., takes issue with the National Resources Planning Board on several features concerning transportation, in its report to Congress. It has this to say about government ownership of the railways: "Support of private enterprise, which the public is justified in expecting, finds no place in the recommendations of the National Resources Planning Board. Government financing is advanced as inevitable when it should be resorted to only after all efforts to bring about private financing have been exhausted. If the government invested heavily in transportation it would, as do all investors, naturally and logically insist upon a degree of supervision; next would come domination; final result—government ownership. . . . Government ownership is not inevitable. There is no public liking for it; there is no public demand for it. It can creep up on us, however, if we are too greatly absorbed in our own petty personal affairs to the neglect of important government issues; if we fail to subordinate selfish interests to the good of our revered republic; if we permit ourselves to forget that eternal vigilance is the price of liberty."

Pullman Records Broken

Approximately two billion passenger-miles were traveled by Pullman on American railways during the month of January. This includes both military and civilian traffic and is 57 per cent in excess of the performance for January, 1942. Total Pullman passenger-miles for the year 1942 exceeded 19 billion, far outstripping the previous all-time record of 14.4 billion in 1926. In addition to the heavy troop movements, civilian requirements have also stepped up sharply.

"Austerity" Locomotives

Shortage of labor and materials has forced the British to go to locomotives of a "simple and robust design." The term "austerity" has been adopted in that country for articles of all sorts that have been redesigned to accommodate them to war conditions. It is perfectly natural, therefore, that these new locomotives should be termed "austerity" locomotives. A number of them have been built in this country, although not directly to the British design. Our builders furnished an equivalent design, but in order to produce it economically had to incorporate certain American features. In commenting upon this, the Railway Gazette of London recently said: "Few locomotive types can have had their portraits taken so often, in so short a time, as the American-built 'Austerity' engines. . . . The striking appearance of these engines, coupled with the fact that they are symbols of an international friendship of immense historical significance, causes them to be the focus of great interest wherever they go. . . . In course of time they will no doubt earn for themselves the tribute which enginemen in this country nearly always pay to notable new classes and be given a nickname expressive of their qualities and of the sentiments they have inspired. We have as yet no inkling of what this nickname is likely to be, but in an American journal the legend beneath a picture of one of the class described it as 'an iron doughboy in battledress.' This, to use another American expression, is something of a bibful and we feel sure that our men will soon improve on it with a name both terse and apt."

Labor's Responsibilities

Director Joseph B. Eastman, of the Office of Defense Transportation, urged labor to give more thought to its responsibilities at a "Keep 'Em Rolling Rally" in Philadelphia, on March 5. Included in his remarks were these statements: "'Uneasy lies the head that wears the crown.' Power brings with it responsibilities. It is also very easy to abuse. When the 'vested interests' had power they abused it. So did the bankers. I wish that along with what is properly said about the rights of labor, more time were spent on the responsibilities which go with power. I have been fortunate enough in my time to know many business men, bankers, lawyers, public office holders and labor leaders. Every one of these groups has its racketeers, its would-be Hitlers, and its tricksters. And every one has its men of honor and responsibility and devotion to the public good. In my judgment, the percentages are about the same in the case of all these groups. I feel that labor unions are in some danger. They are new to power. Here and there it has gone to their heads somewhat, and in some cases they have allowed abuse to creep in. They are for liberty and democracy, they are against tyranny and despotism, but have they always carried these precepts into practice in their own affairs? They demand that business men be held to public accounting, but are they willing to be so held themselves? The pendulum always swings from one extreme to the other. There is danger of a public reaction against labor unions, and already I see signs that it is setting in. If their houses are not in order, I suggest that they clean these houses themselves."

Standard Gage from Egypt into Turkey and Iraq

The completion of a strip of standard-gage railway between Beirut and Tripoli in Syria will make it possible to travel over standard-gage railway lines from Egypt through Palestine and Syria, into Turkey and Europe on the north, and as far east and south as Baghdad in Iraq. While the low level route along the coast between Beirut and Tripoli was chosen to avoid extensive bridge work if the line was projected away from the coast, it did involve some difficult engineering. Several tunnels, one at least a mile long, had to be cut through almost solid rock. The work on this last link connecting the standard-gage lines was performed in record time. A working force of 3,000 men completed the task in nine months, using materials from India, Burma, Turkey and the United States.

(*Turn to next left-hand page*)

THE RAILROADS KEPT EQUIPMENT ROLLING IN 1942!

To increase freight ton miles 35 per cent over 1941, 72 per cent over 1940, and 43 per cent over 1929, without an increase in rolling stock, demonstrates that the railroads attained maximum road capacity and made the most effective use of equipment!

And the wheels, under such severe operating conditions, had to be good to carry this record-breaking load! To obtain maximum use of existing rolling stock, it could not be kept out of service long for necessary wheel changes. The change-over had to be made quick to minimize lay-up time of sorely needed rolling stock.



CHILLED CAR WHEELS SOLVED THIS PROBLEM



With 38 foundries strategically located in the United States and 8 in Canada, the railroads secured quick Chilled Car Wheel delivery and low delivery costs.



Under our wheel exchange plan, by which the railroads receive new Chilled Car Wheels for old on a conversion charge basis, scrapped wheels are speedily recast into new and better wheels.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

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NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW 3262

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

NEWS

Leiserson, Schwartz NMB Appointees

CONFIRMATION by the Senate on February 25 of President Roosevelt's nominations of Dr. William M. Leiserson and former Senator H. H. Schwartz of Wyoming to be members of the National Mediation Board has restored the full membership of that Board which was left with only one active member—Chairman George A. Cook —when David J. Lewis retired on February 1. Dr. Leiserson has since been elected chairman of the N.M.B. succeeding Mr. Cook.

Dr. Leiserson, a former member of N. M. B. who was transferred in 1939 to the National Labor Relations Board, has been appointed to the National Mediation Board for a full three-year term ending February 1, 1946. Since last June he has served as chairman of the National Railway Labor Panel which President Roosevelt's May 21, 1942, executive order created to provide wartime procedures whereby labor-management disputes in the railroad industry may be submitted to emergency fact-finding boards without the necessity for taking strike votes. Dr. Leiserson continues also as chairman of the panel.

Former Senator Schwartz, defeated for reelection last November, was appointed for the unexpired term, ending February 1, 1944, of Otto S. Beyer, who resigned after having been on leave of absence for more than a year while serving on a full-time basis as director of the Office of Defense Transportation's Division of Transport Personnel.

WPB Car Deliveries for First Half of 1943

RELEASES have been granted by the War Production Board covering the building of 19,971 of the 20,000 cars authorized by the board for construction during the first six months of 1943. One of the accompanying tables summarizes the cars released by types; the other, the reported allocations to railroads and builders.

Summary Table of WPB Authorizations

	Contract Car Builders	Railroad Shops	Total
Hopper	8,355	1,150	9,505
Gondola	4,048	2,735	6,783
Ore	2,100	....	2,100
Flat	725	701	1,426
Tank	120*	....	120
Special Box	37*	....	37
	15,385	4,586	19,971
Unallocated	29	....	29
Total	15,414	4,586	20,000

* Ordered by industrial companies.

Freight-Car-Building Program, First Six Months, 1943
WPB Authorizations Reported to February 27

Name of Railroad	No.	Type	Builder
Ann Arbor	50*	Hopper	Company Shops
Atchison, Topeka & Santa Fe	300	Ore	American Car & Foundry
	200*	Hopper	Pullman-Standard
	200*	Gondola	Pullman-Standard
Atlantic Coast Line	550*	Hopper	Bethlehem Steel Co.
	700*	Gondola	Bethlehem Steel Co.
	300*	Flat	Pullman-Standard
Baltimore & Ohio	525*	Hopper	Bethlehem Steel Co.
Bessemer & Lake Erie	800	Ore	Pullman-Standard
Central of Georgia	100*	Hopper	Pullman-Standard
Central of New Jersey	500*	Gondola	Bethlehem Steel Co.
Chesapeake & Ohio	500*	Hopper	General American
	1,250*	Hopper	Pullman-Standard
Chicago & Illinois Midland	38*	Gondola	Mather Stock Car Co.
Chicago, Milwaukee, St. Paul & Pacific	630	Gondola	General American
	400*	Flat	Company Shops
	735*	Gondola	Company Shops
Chicago, Rock Island & Pacific	400*	Gondola	Pressed Steel
Denver & Rio Grande Western	450	Gondola	Mount Vernon
	220	Gondola	Pressed Steel
Duluth, Missabe & Iron Range	500	Ore	Pressed Steel
Elgin, Joliet & Eastern	300	Hopper	Ralston
	440	Gondola	Ralston
Great Northern	500	Ore	General American
International- Great Northern	100*	Flat	American Car & Foundry
Lehigh Valley	500*	Hopper	Bethlehem Steel Co.
Louisville & Nashville	650*	Hopper	Pullman-Standard
Missouri Pacific	450*	Hopper	American Car & Foundry
New York Central	300*	Flat	Despatch Shops
	1,000*	Gondola	Despatch Shops
Norfolk & Western	100*	Gondola	Pressed Steel
Northern Pacific	300*	Flat	American Car & Foundry
	250*	Hopper	American Car & Foundry
Pennsylvania	1,000*	Gondola	Company Shops
	1	Flat	Company Shops
Reading	700*	Hopper	Company Shops
Southern	1,450*	Hopper	Pullman-Standard
	1,000*	Gondola	Mount Vernon
Union Pacific	1,000*	Hopper	American Car & Foundry
Wabash	400*	Hopper	Company Shops
Western Maryland	25*	Flat	American Car & Foundry
Industrial Companies	105	Tank	General American
	15	Tank	American Car & Foundry
	37	Other	General American
Unallocated	1,100		
Total	19,971		

* Composite wood and steel construction.

WPB Appointments

DONALD M. NELSON, chairman of the War Production Board, has appointed Charles E. Wilson, former president of the General Electric Company, as executive vice-chairman "in charge of all WPB programs." Ferdinand E. Eberstadt, program vice-chairman, has resigned at the request of Mr. Nelson. Ralph J. Cordiner, who has been director-general for war production scheduling, has become a vice-chairman of WPB and serves as a special assistant to Mr. Wilson. J. A. Krug, director of the Office of War Utilities, has been named vice-chairman of the WPB in charge of materials distribution. He is also chairman of the Requirements Committee and continues to serve as War Utilities director. Donald D. Davis, recently director of the Program Bureau, is now WPB vice-chairman for operations. Curtis Calder, former director general for operations, is executive assistant to Mr. Wilson.

William L. Batt continues to serve as a WPB vice-chairman, and Col. Robert E. Johnson, head of the Smaller War Plants Corporation, retains the rank of deputy chairman.

Car Plants Must Use Surplus Inventory Stocks

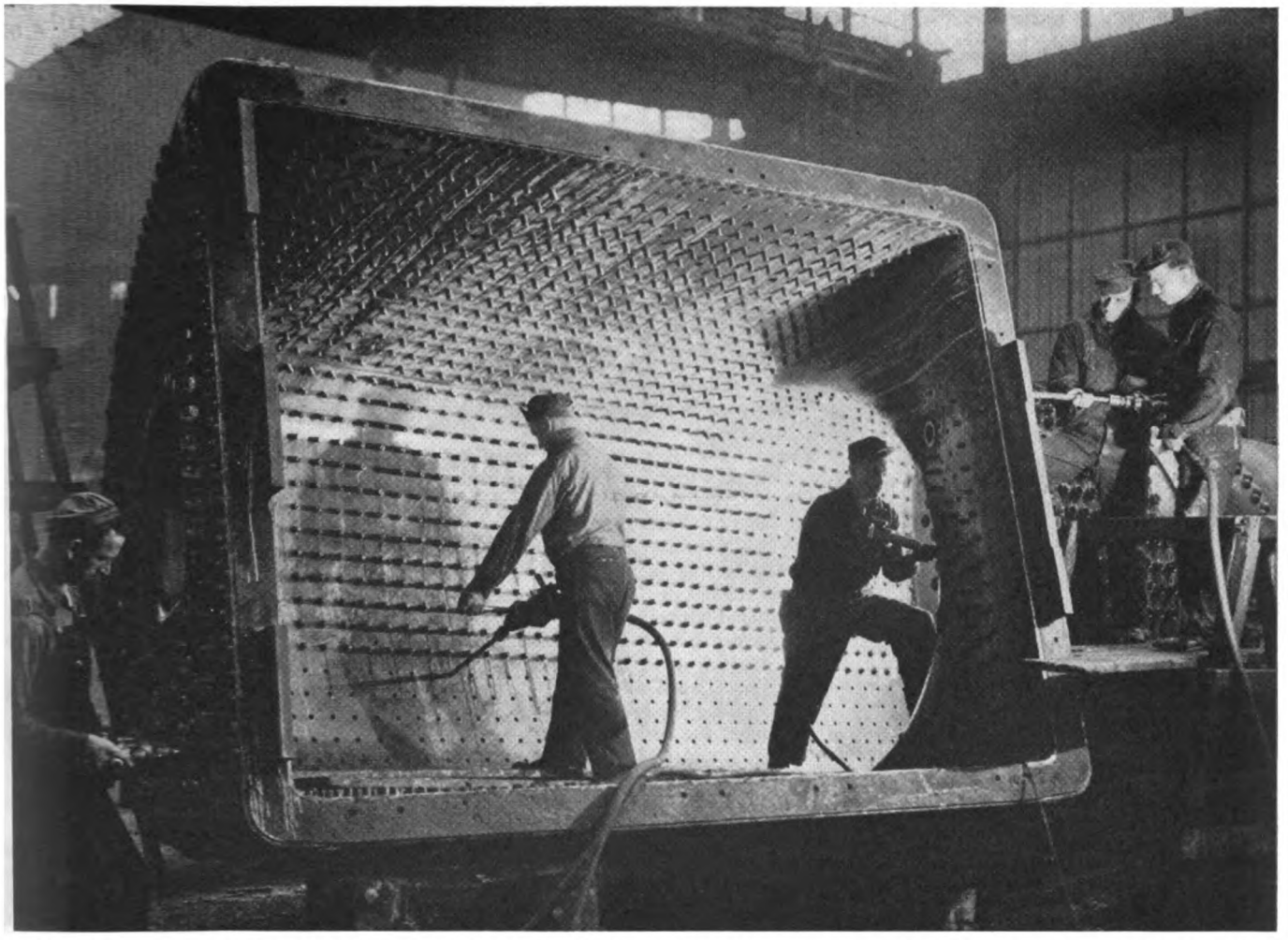
ACTION intended to require freight-car builders to use their surplus inventory stocks and thereby reduce the volume of new material required was taken February 24 by the War Production Board in the form of Supplementary Limitation Order L-97-a-1, amended, a further revision of the April 4, 1942, order "freezing" car materials, which already had been liberalized to allow exchanges of materials in stock.

The order in its present form is intended not merely to permit, but to require, reductions of stocks of surplus parts. It is designed, the WPB states, to relieve situations where car purchasers specify accessories of different manufacture than those in stock, and directs the builder to substitute parts on hand, where they are interchangeable, for those specified by the purchaser.

Equipment-Purchasing and Modernization Programs

CANADIAN NATIONAL.—The first 50 units of an order for 900 all-steel 40-ton box cars have been delivered to the Canadian National at Hamilton, Ont., by the National Steel Car Corporation. It is anticipated

(*Continued on next left-hand page*)



At Lima particular attention is paid to the application of staybolts. This care in every phase of construction has an important bearing on future locomotive maintenance.

Locomotives Have A Bigger Job In 1943!

1943 will be a critical year for American railroads. In the words of Mr. Joseph B. Eastman, ". . . Looking ahead into 1943 . . . the remarkable transportation achievements of the past year must be excelled and the job will be performed with increasing difficulty. Performed it will be, however, because it must."

Transportation's increased responsibility in 1943 rests in large part upon motive power . . . locomotives that can be relied upon to provide increased gross-ton-miles per train hour—a problem requiring long-lived dependable power.

Dependability has been built into the Lima locomotives now serving many American Railroads . . . all the dependability that can be gained from modern manufacturing methods, skilled craftsmanship and an experience stretching over three quarters of a century.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED INCORPORATED, LIMA, OHIO

that approximately 15 of these cars will be completed daily when the builders get into full production.

Missouri Pacific.—The Missouri Pacific has been granted permission by the District Court to spend $8,566,345 for improvements to its roadway and equipment. Of this total, $7,216,830 will be spent on the Missouri Pacific; $693,765 on the New Orleans, Texas & Mexico; $530,820 on the International Great Northern; and $124,930 on the Missouri-Illinois.

New York, Chicago & St. Louis.—The Nickel Plate has applied to the Interstate Commerce Commission for authority to assume liability for $1,230,000 of equipment trust certificates to be issued in connection with the financing of the purchase of the 10 locomotives of the 2-8-4 type ordered from the Lima Locomotive Works as noted elsewhere in this issue. The total cost of the locomotives is expected to be $1,567,485.

St. Louis-San Francisco.—The road has been authorized by the District Court to spend $3,138,246 for improvements to road and equipment during 1943. The trustees also plan to purchase 20 locomotives, including 10 Diesels and 10 steam, at a cost of $2,735,330.

Approved Steam Locomotive Orders

THE accompanying table summarizes the domestic railroad steam locomotive building situation and groups locomotive orders and allocations previously reported separately from time to time in the table of Orders and Inquiries for Equipment published each month in the *Railway Mechanical Engineer*. Where the month in which deliveries are scheduled to begin was not available, the locomotives are simply listed as for delivery this year. While all of the locomotives are reported to have government authorization for building, WPB confirmation to this effect has not been received.

Orders and Inquiries for New Equipment Placed Since the Closing of the March Issue

Road	Locomotive Orders No. of Locos.	Type of Loco.	Builder
Atchison, Topeka & Santa Fe	10[1]	4-8-4	Baldwin Locomotive Wks.
Baltimore & Ohio	20	2-8-4-4	Baldwin Locomotive Wks.
Bessemer & Lake Erie	5[1]	2-10-4	Baldwin Locomotive Wks.
Chesapeake & Ohio	40	2-8-4	American Locomotive Co.
New York, Chicago & St. Louis	15[1]	2-8-4	Lima Locomotive Wks.
Pennsylvania	50	2-10-4	Company Shops
Southern Pacific	20[2]	4-8-8-2 (pass.-fit.)	Baldwin Locomotive Wks.

[1] For 1943 delivery.
[2] Approximate cost $5,000,000. Delivery expected to begin in October.

Certain railroad orders placed in 1942 were increased in size early this year when WPB approved the building in 1943 of a larger number of locomotives for these particular carriers than were already on order. Thus, the Atchison, Topeka & Santa Fe, which had 20 4-8-4 type locomotives on order since November, 1942, received WPB authorization this year covering the building of 30 engines of this type, the order for the additional ten being placed in February. The Bessemer & Lake Erie, which had five 2-10-4 type locomotives on order but "frozen" since April, 1942, received authorization covering the building of 10 engines of this type, the order for the additional five being placed in February.

Railroad orders placed in 1942 which are reported still without WPB authority to build include the Chesapeake & Ohio order for ten 0-8-0 type engines for switching service placed in January with the Lima Locomotive Works; the Detroit, Toledo & Ironton order for four 2-8-2 type engines for freight service placed in April with Lima; the Indianapolis Union order for three 0-8-0 type engines for switching service placed in June with the Baldwin Locomotive Works; and the Lehigh & Hudson River order for three 4-8-2 type engines for freight service placed in May with Baldwin.

Proceedings Coordinated Mechanical Associations

THE reports and addresses prepared for the 1942 year books of two of the Coordinated Mechanical Associations have been published as follows:

Master Boiler Makers' Association.—A. F. Stiglmeier, secretary-treasurer, 29 Parkwood street, Albany, N. Y. 142 pages. Price, $5.

The Railway Fuel and Traveling Engineers' Association.—T. Duff Smith, secretary, 327 South La Salle street, Chicago. 198 pages. Price, $3.

Army Invites Suggestions for New Devices and Methods

CIVILIANS as well as soldiers are invited by the Army Engineers to send in their suggestions for new devices and methods, which may help the Army do its vital work more efficiently. The whole range of Army techniques is embraced in the Engineers' invitation and, of course, including all phases of transportation.

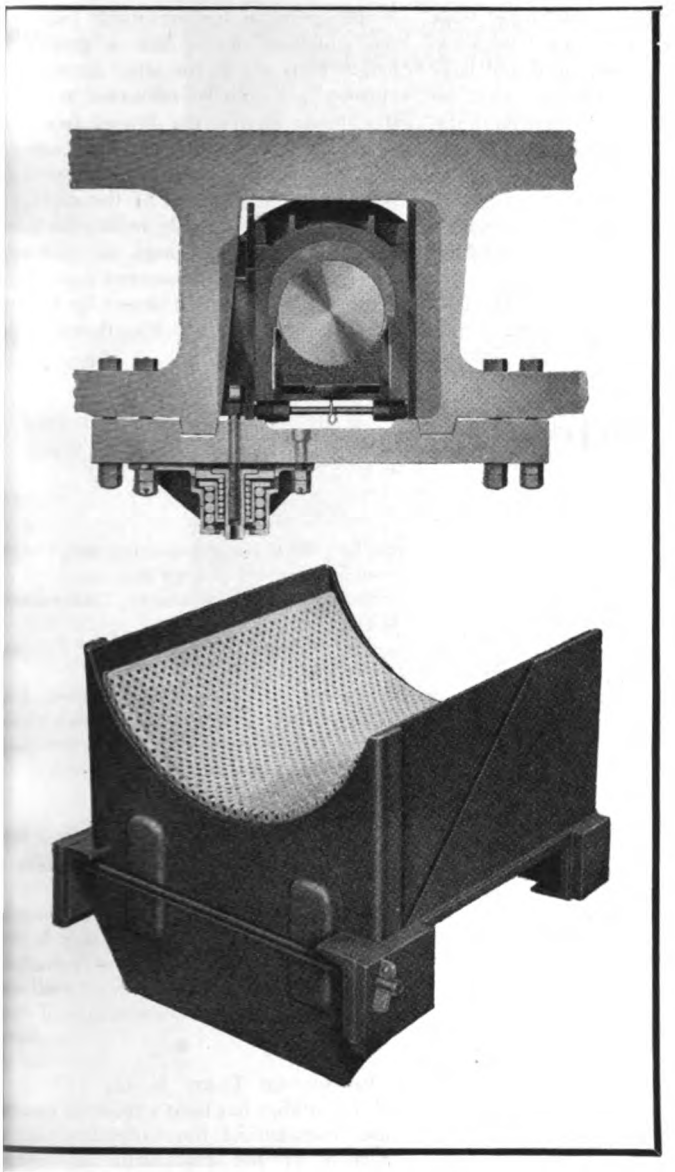
Suggestions should be sent to the Engineer School, Fort Belvoir, Virginia. So far 11 per cent of the ideas submitted have been put to practical use.

Railroad Steam Locomotive Building Program, 1943

Name of Railroad	No.	Type	Service	Date of Order	Date of Delivery	Builder
Atchison, Topeka & Santa Fe	20*	4-8-4	Freight	Nov. '42	1943	Baldwin Locomotive Works
	10	4-8-4	Freight	Feb. '43	1943	Baldwin Locomotive Works
Baltimore & Ohio	20	2-8-8-4	Freight	Feb. '43	1943	Baldwin Locomotive Works
Bessemer & Lake Erie	2	0-8-0	Sw.	Apr. '42	1943	American Locomotive Company
	5*	2-10-4	Freight	Apr. '42	1943	Baldwin Locomotive Works
	5	2-10-4	Freight	Feb. '43	1943	Baldwin Locomotive Works
Central of Georgia	8*(a)	4-8-4	Pass. & Frt.	Nov. '42	June '43	Lima Locomotive Works
Chesapeake & Ohio	40	2-8-4	Pass. & Frt.	Feb. '43	Late 1943	American Locomotive Company
Delaware & Hudson	15	4-8-4	Freight	Feb. '42	1943	American Locomotive Company
Denver & Rio Grande Western	6(a)	4-6-6-4	Freight	Sept. '42	1943	American Locomotive Company
Duluth, Missabe & Iron Range	10	2-8-8-4	Freight	Mar. '42	Dec. '42–Mar. '43	Baldwin Locomotive Works
Lehigh Valley	10*	4-8-4	Freight	Nov. '42	1943	American Locomotive Company
Missouri Pacific	15*	4-8-4	Freight	Nov. '42	1943	Baldwin Locomotive Works
Nashville, Chattanooga & St. Louis	10*	4-8-4	Freight	Nov. '42	1943	American Locomotive Company
New York Central	25	4-8-2	Freight	Feb. '42	Nov. '42–Jan. '43	Lima Locomotive Works
	25	4-8-2	Freight	Jan. '43	July–Aug. '43	Lima Locomotive Works
New York, Chicago & St. Louis	10	2-8-4	Freight	Feb. '42	1943	Lima Locomotive Works
	15	2-8-4	Freight	Feb. '43	Oct. '43	Lima Locomotive Works
Norfolk & Western	10	2-6-6-4	Freight	Apr. '42	Jan.–Mar. '43	Company Shops
	5*	2-6-6-4	Freight	Apr. '42	1943	Company Shops
Northern Pacific	12	4-6-6-4	Freight	Feb. '42	Jan. '43	American Locomotive Company
	10*	4-8-4	Freight	Feb. '42	1943	Baldwin Locomotive Works
Pennsylvania	25	2-10-4	Freight	Mar. '42	Feb. '43	Company Shops
	10	2-10-4	Freight	Sept. '42	Mar. '43	Company Shops
	50	2-10-4	Freight	Jan. '43	1943	Company Shops
Richmond, Fredericksburg & Potomac	10	2-8-4	Freight	Mar. '42	Jan.–Feb. '43	Lima Locomotive Works
St. Louis-San Francisco	10*	4-8-4	Freight	Nov. '42	1943	Baldwin Locomotive Works
St. Louis Southwestern	5	4-8-4	Freight	1942	Dec. '42–Feb. '43	Company Shops
Southern Pacific	30	4-8-8-2	Pass. & Frt.	Mar. '42	Nov. '42–Mar. '43	Baldwin Locomotive Works
	10	4-8-4	Freight	Mar. '42	Apr.–May '43	Lima Locomotive Works
	20	4-8-8-2	Pass. & Frt.	Feb. '43	Oct. '43	Baldwin Locomotive Works
Union Pacific	25	4-6-6-4	Freight	Feb. '42	1943	American Locomotive Company
Western Pacific	6	4-8-4	Freight	July '42	Apr. '43	Lima Locomotive Works
Total	489					

* These locomotives ordered in 1942, as shown in date of delivery column, but building not authorized by War Production Board until after January 1, 1943.
(a) Order originally placed with Baldwin Locomotive Works and subsequently otherwise allocated by WPB.

(*Turn to next left-hand page*)



PROTECT BEARINGS

Save vital materials

and Prolong Mileage between Shoppings



EVERY LOCOMOTIVE is needed on the road. Time out for maintenance must be kept to a minimum. » » Helping to keep power in service are two Franklin devices that protect driving box bearings — The Automatic Compensator and Snubber and the Driving Box Lubricator. » » The first prevents slack from accumulating by automatically compensating for normal wear and temperature changes. » » The Driving Box Lubricator insures constant lubrication. The latest No. 8 design makes re-packing easier. It weighs much less and has a spreader to hold box parallel.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

Truck Spring Snubbers Excessively Loaded

A CIRCULAR letter issued recently by the A. A. R. Mechanical Division, calls attention to reports that some truck spring snubbers recently placed in service are failing due to being applied to spring clusters where the free height of the standard truck springs is reduced to a considerable extent. These reports have been considered by the Committee on Car Construction and the Joint Committee on Helical Springs for Freight Cars.

It is stated in the circular letter that where snubbing devices are used with old springs (which may be corroded and have taken a considerable permanent set), an undue burden is placed on the snubbing devices, which may be the cause of their early failure.

When spring snubbers are applied, it is recommended that the entire spring cluster be checked carefully to insure a minimum average free height of 8 in. for springs remaining in each nest. Springs badly corroded or pitted should be replaced. Also, if the spring at the preferable location for the snubbing device has a greater free height than any of the other springs in the cluster, it should be relocated in place of the spring having the lowest free height.

Rejection of springs with excessive set (denoting fatigue and with little service life remaining) at the time of the snubber applications should greatly reduce the damage caused by broken springs, as well as expense and delay in subsequent replacements, according to the letter signed by Executive Vice-Chairman V. R. Hawthorne.

Supply Trade Notes

FRED C. DAVERN has been appointed manager of railroad sales for the Standard Oil Company of New Jersey.

◆

COPPERWELD STEEL COMPANY.—*William J. McIlvane* has been appointed vice-president in charge of sales and assistant to the president of the Copperweld Steel Company, Glassport, Pa.

◆

WESTINGHOUSE AIR BRAKE COMPANY.—*G. L. Cotter* has been appointed district engineer at Chicago to fill the vacancy caused by the death of *J. S. Y. Fralich*. Mr. Cotter, a mechanical engineering graduate of the University of Michigan, entered the service of the Westinghouse Air Brake Company as a special apprentice in 1923. He was in the engineering department and test division, commercial engineering division, and district engineer for the central district. In 1940, he was promoted to the position of commercial engineer in charge of the commercial engineering division, which position he held until his current promotion.

G. W. Misner, a graduate of the University of Michigan in mechanical engineering, entered the employ of the Westinghouse Air Brake Company as a special apprentice in 1924. He joined the commercial engineering division in 1929 and was appointed district engineer for the central district in 1938.

T. W. Masterman, a graduate of the School of Industries, Carnegie Institute of Technology, began a special apprenticeship course with the Westinghouse Air Brake Company in 1920, immediately after graduation, and served successively as special engineer, field engineer, and test engineer. He was transferred to the commercial engineering division in 1930, from which position he was promoted to district engineer.

◆

WHITING CORPORATION (CANADA), LTD.—*H. M. Rowlette* has been elected vice-president and general manager, with headquarters at the company's new offices at 45 Richmond street, W., Toronto, Ont., to succeed *Colonel James Mess,* who is now employed full-time with government duties at Ottawa. Mr. Rowlette has been with the parent company, the Whiting Corporation, at Harvey, Ill., since 1912.

THOMAS A. EDISON, INC.—*William W. Gould,* electrical supervisor for the Reading at Philadelphia, Pa., has joined the Thomas A. Edison, Inc., Edison Storage Battery division, as field engineer with headquarters at Philadelphia. Mr. Gould was graduated from the University of Manitoba with a degree in electrical engineering in 1925, and his first railroad



William W. Gould

work was with the Illinois Central, where he was power supervisor from 1925 to 1938. Prior to his association with the Reading, he was with Jackson & Moreland Consulting Engineers for 12 years and worked on design, inspection and construction in connection with the suburban electrification of the Delaware, Lackawanna & Western.

◆

MAGNUS CHEMICAL COMPANY, INC.—*J. D. Holmes* has been appointed manager of the newly organized Feedwater Treating Division of the Magnus Chemical Company, Inc., Garwood, N. J.

◆

BY-PRODUCTS STEEL CORPORATION.—*Harry R. Meyer* has been appointed general manager of sales, with headquarters at Coatesville, Pa. Mr. Meyer was formerly manager of direct sales for the Lukens Steel Company, of which the By-Products Steel Corporation is a subsidiary.

◆

PITTSBURGH PLATE GLASS COMPANY.—*W. I. Galliher* has been appointed executive sales manager of the Columbia Chemical division of the Pittsburgh Plate Glass Company, succeeding *Eli Winkler,* who continues with the company in the capacity of executive consultant. *Louis F. Theurer,* industrial sales manager of the Milwaukee (Wis.) paint division has been appointed west coast divisional director, succeeding *Floyd S. Green,* retired. *R. I. Ogle,* industrial paint sales representative in the Chicago territory has been appointed industrial sales manager at Milwaukee.

Army-Navy E Awards

S. E. Bowser & Co., Inc., Fort Wayne, Ind. Second award.

Edward G. Budd Manufacturing Company, Philadelphia, Pa. Third award.

Bullard Company, Bridgeport, Conn. Second award.

Caterpillar Tractor Company, Peoria, Ill. March 12.

International Nickel Company, Huntington, W. Va. Fourth award.

Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. Second award.

Pressed Steel Car Company, McKees Rocks, Pa. March 23.

Union Asbestos and Rubber Company, Chicago. February 22.

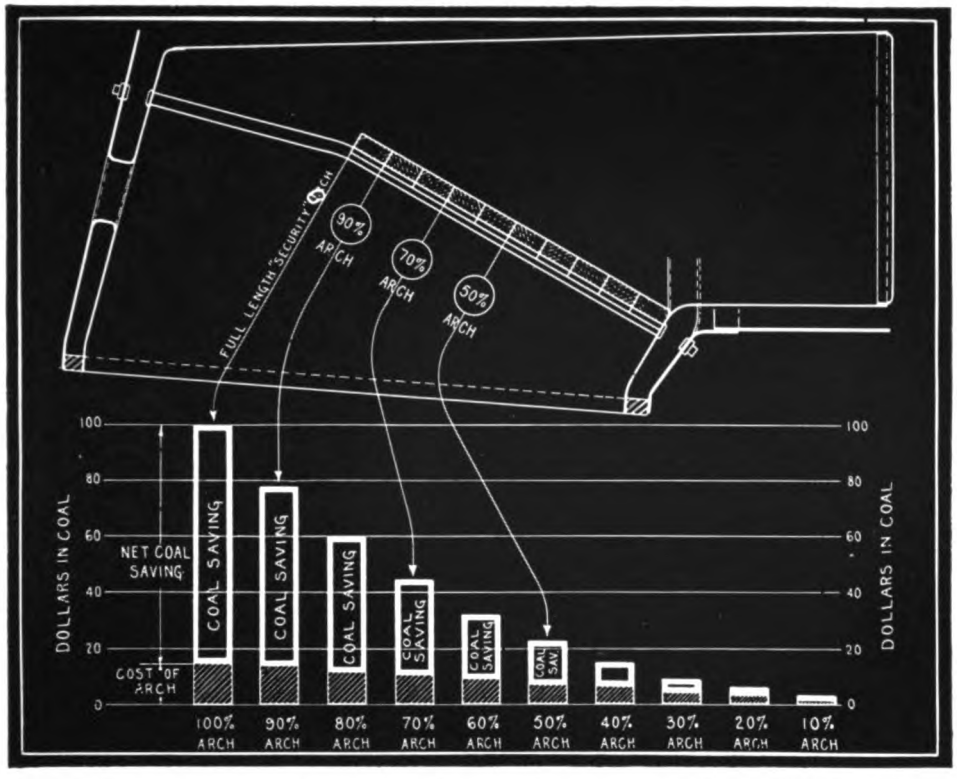
Obituary

UNITED STATES STEEL CORP.—*Percival Roberts,* a member of the first board of directors of the United States Steel Corporation, who served on the board for 34 years prior to his retirement in 1935, died March 6. He was 86 years of age.

◆

GENERAL ELECTRIC COMPANY.—*John G. Barry,* honorary vice-president of the General Electric Company, died on March 4. He was 75 years of age. Mr. Barry retired as senior vice-president of General Electric on July 1, 1935, after more than 45 years' service. He entered the electrical industry as an apprentice and test man with the Thomson-Houston Company, a prede-

(*Continued on second left-hand page*)



THE EFFECT OF ABBREVIATED ARCHES ON FUEL SAVING

FUEL CONSERVATION... a wartime need!

Fuel wastage is a two-fold loss; the fuel itself and the transportation necessary to haul it. Because of the strategic importance of fuel to the war program every effort must be made to conserve this vital material.

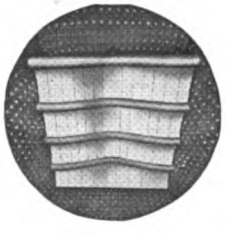
The fuel economy of Security Sectional Arches has been thoroughly proved in over 32 years of service on American railroads. But only a *complete* Arch can produce maximum fuel savings.

You need a full Arch for full fuel economy.

THERE'S MORE TO SECURITY ARCHES THAN JUST BRICK

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists

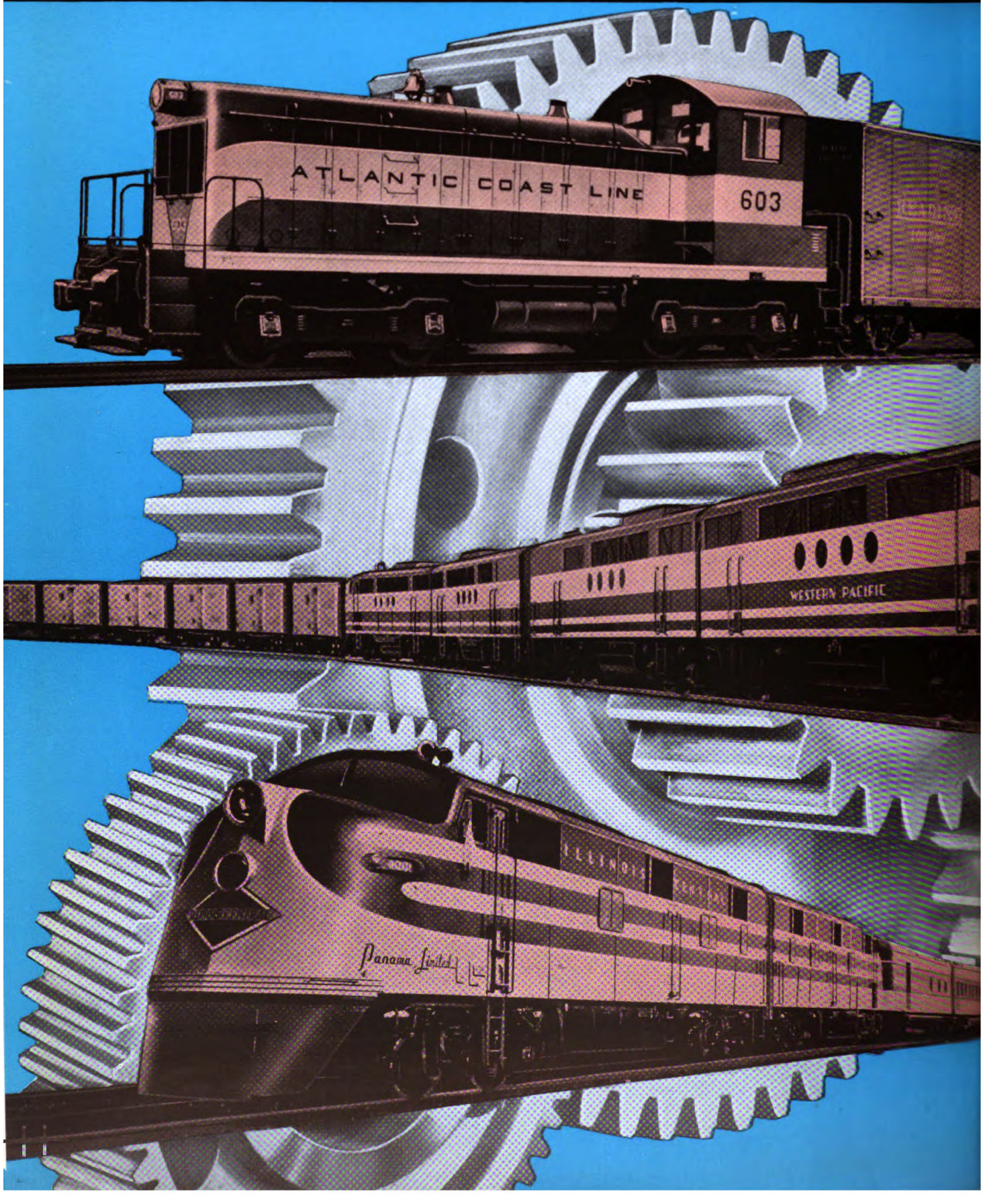


AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

PULLING T

TO WIN THE WAR A



OGETHER...

WRITE THE PEACE



ALL AMERICA is united in producing and delivering, with ever-increasing quantities and speed, the equipment, materials and supplies which are so vital to our armed forces. All industries, agriculture, transportation, et cetera, are being called upon to shoulder unprecedented responsibilities. By far the greatest burden of war-time production falls upon the railroads and anything which impedes transportation weakens the entire war effort.

Transportation must be kept at peak efficiency and General Motors Diesel Locomotives, in all classes of service, are doing an outstanding job. GM Diesel Switchers are preventing costly bottlenecks by speeding up heavy traffic through terminals. GM Diesel Road Locomotives in passenger service are doing their part in all-time record troop movements, and in freight service are making possible super-performances, such as — reduction in train miles as much as 50 percent — greater hauling capacity — faster schedules with fewer service delays — high availability — increased carrying capacity of existing track facilities without the expense of replacing rail or rebuilding bridge structures.

TRANSPORTATION IS VITAL FOR VICTORY

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILLINOIS, U. S. A.

GENERAL MOTORS
LOCOMOTIVES

cessor of General Electric, at Lynn, Mass., in 1885. Completing his apprentice training in 1890, he was assigned to the construction department of Thompson-Houston, later going to the company's Boston, Mass., office. In 1892, when the General Electric Company was formed, he became a member of the railway department. He was transferred from Boston to New York, and then to Schenectady, N. Y., where he became assistant manager of the railway



John G. Barry

department in 1897, and manager in 1907. He was appointed to the position of general sales manager in 1917, while still retaining the managership of the railway department, and became a vice-president in June, 1922. Mr. Barry played an active role in civic affairs in Schenectady, serving as a member of the board of education and as fuel administrator for the district during World War I.

◆

ARTHUR A. HALE, vice-president and a director of the Griffin Wheel Company, died at Coral Gables, Fla., on February 21. Mr. Hale was born in 1884 and was



Arthur A. Hale

a graduate of the University of Illinois in 1905. On July 1 of that year Mr. Hale entered the employ of the Griffin Wheel Company as assistant to the chief engineer and on May 26, 1911, was appointed sales agent at Boston, Mass. On August 1, 1922, he was promoted to the position of eastern sales manager, with headquarters at New York, and on June 1, 1927, was elected a vice-president. A year later he was transferred to Chicago and on February 6, 1939, became a director.

◆

CLAUDE W. BENDER, who retired on April 1, 1938, as general manager of the Mississippi Valley division of the lamp department of the General Electric Company, died on January 24. Mr. Bender was 66 years of age. He had been associated with the General Electric Company for nearly 30 years and at the time of his death was acting in an advisory capacity for the Mississippi Valley division. He began his career in the electrical department of the Altoona, Pa., shops of the Pennsylvania in 1889, leaving railroad work for a few months in 1902 to join the Royal Hanna Coal & Coke Co. as electrical engineer. He returned to the Pennsylvania in that same year as a draftsman in the electrical engineering department at Altoona and was appointed assistant to the electrician, motive power department, Lines East, in 1903. He joined the National Lamp Company (later the National Lamp Works of the General Electric Company) as commercial engineer in 1909 and was appointed manager of the commercial development department in 1913. He was appointed manager of the division which was the forerunner of the Mississippi Valley division at St. Louis, Mo., in 1923, from which posi-



Claude W. Bender

tion he retired in 1938. Mr. Bender prepared the Railway Electrical Engineers' Handbook, Electric Light and Illumination, which was published by the engineering department of the National Electric Lamp Association.

◆

FORT PITT MALLEABLE IRON COMPANY, DAVIS BRAKE BEAM CO.—*Frank J. Lanahan,* president of the Fort Pitt Malleable Iron Company of Pittsburgh, Pa., and the Davis Brake Beam Company of Johnstown, Pa., died on March 2. He was 72 years of age.

◆

STANTON HERTZ, vice-president and assistant to the president of the Copperweld Steel Company, Glassport, Pa., died on February 27. Mr. Hertz was 48 years of age. He was a graduate of the Alabama Polytechnic Institute and was a lieutenant in the Engineers Corps in World War I. He began his career with the Copperweld Steel Company in 1921 and served successively as chief engineer at the New York office, general manager of sales and



Stanton Hertz

vice-president. He was executive director of the Copper Wire Engineering Association from 1936 to 1941, and returned to Copperweld in 1941 as vice-president and assistant to the president.

◆

JAMES G. BLUNT, assistant to the vice-president in charge of engineering of the American Locomotive Company, who died on February 15, as noted in the March issue, was 74 years of age. He received a degree in mechanical engineering from the University of Michigan in 1894. During his early business career he was employed as a machinist at the Buda Company, Harvey, Ill.; a draftsman at the Welland Iron

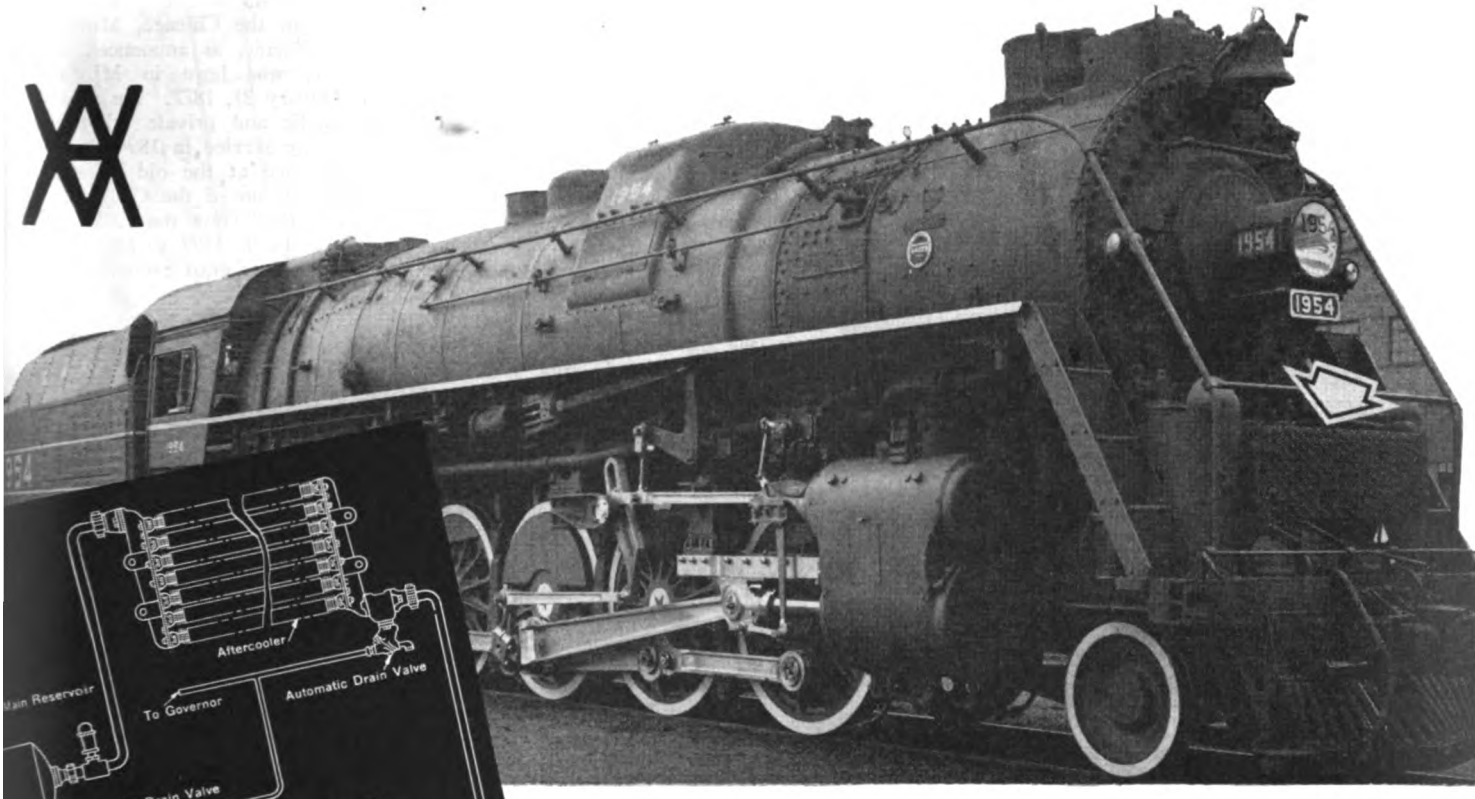


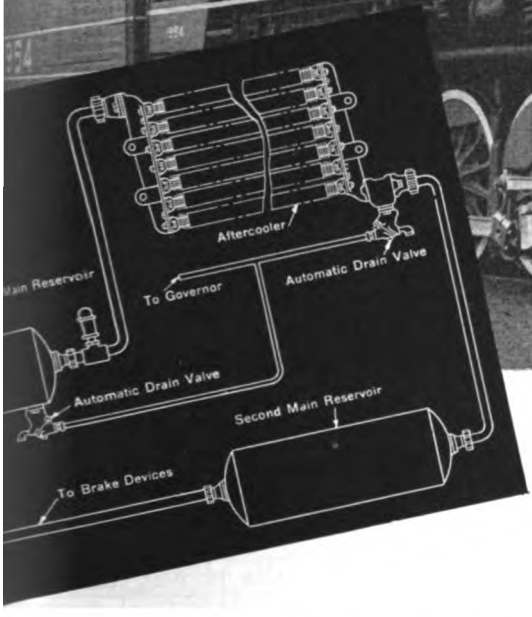
James G. Blunt

Works, Welland, Ont., and a draftsman in the employ of the Bucyrus Company and the Industrial Works, Bay City, Mich. In 1897 he took a position as draftsman with the Brooks Locomotive Works at Dunkirk, N. Y., becoming chief draftsman in 1899. In 1906, following the formation of the American Locomotive Company, of which the Brooks Locomotive Works became a part, Mr. Blunt was transferred to Schenectady and appointed engineer of the drafting department. He became mechanical engineer in 1916, chief mechanical engineer in 1936, and assistant to the vice-president in charge of engineering in 1941

(*Turn to next left-hand page*)

DRY AIR is a Help in *Maintaining* *Satisfactory* BRAKE PERFORMANCE ... achieved with the *Aftercooler*





In charging trains from yard air supply, be sure to blow water from line before connecting to brake pipe.

At regular intervals drain accumulated moisture from main reservoir, filters, and dirt collectors to prevent its reabsorption into the system.

Do not let gummy dirt accumulate on conventional radiating pipe to reduce its normal cooling effect, and be sure no obstruction prevents free circulation of air around coils.

RELIABLE brake operation—so essential to continuity of train service—is sometimes difficult to maintain if free water gets into the system. Valvular action may then be deranged by freezing, or destroyed lubrication. ★ This trouble is alleviated by **our radiator type Aftercooler having automatic drain valve—a compact arrangement of parallel finned tubes that can readily be located in the path of natural air currents. It produces a far better cooling effect than the conventional type of radiating pipe, and automatically ejects precipitated moisture every time the compressor governor operates.** ★ **On hundreds of locomotives, the Aftercooler is demonstrating its merits as an effective means to assure dry air for the brake system. It promises distinct advantages for YOUR new motive power also . . . In the meantime . . .**

These suggestions may be helpful.

WESTINGHOUSE AIR BRAKE CO.

WILMERDING, PENNSYLVANIA

Personal Mention

General

CLARKSON T. HUNT, master mechanic of the Philadelphia division of the Pennsylvania at Harrisburg, Pa., who has been appointed superintendent of motive power of the Southwestern division with headquarters at Indianapolis, Ind., as announced in the March issue, is a graduate of Lehigh University, and entered railway service on



Clarkson T. Hunt

June 21, 1915, in the Altoona (Pa.) works of the Pennsylvania. He served in various capacities on several divisions of the Eastern region and in the general offices at Philadelphia, and on October 16, 1939, was appointed master mechanic of the Philadelphia division. On February 1, 1943, he became superintendent of motive power of the Southwestern division.

V. L. GREEN has been appointed assistant mechanical engineer of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, Wis.

ALFRED E. CALKINS, assistant to the general superintendent, motive power and rolling stock of the New York Central with headquarters at New York, has retired after 51 years of service.

M. P. NUNNALLY, since July 1, 1942, acting mechanical engineer of the St. Louis Southwestern, has been appointed mechanical engineer, with headquarters at Pine Bluff, Ark.

W. F. FREUTEL, general electrical inspector of the Chesapeake & Ohio, has been appointed assistant electrical engineer, with headquarters at Richmond, Va. The position of general electrical inspector has been abolished.

H. G. MILLER, assistant mechanical engineer of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed mechanical engineer, with headquarters as before at Milwaukee, Wis.

S. J. FULLER, former general foreman, car department, who has been serving as assistant mechanical engineer of the St. Louis Southwestern since July 1, 1942, is now assistant mechanical engineer.

E. J. KUECK, mechanical engineer of the St. Louis Southwestern, has been appointed assistant superintendent of motive power, with headquarters at Pine Bluff, Ark.

W. W. BATES, assistant district master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed assistant to the superintendent of motive power, with headquarters as before at Milwaukee, Wis.

EDGAR M. WHANGER, assistant to the vice-president of the Pere Marquette, with headquarters at Detroit, Mich., has been appointed assistant to the president. Mr. Whanger was born on August 29, 1899, at Fort Spring, W. Va., and obtained his college education at Washington and Lee University, Lexington, Va., graduating in 1919. He first entered railway service on March 4, 1912, with the Chesapeake & Ohio, serving intermittently while attending school, as a messenger, timekeeper and accountant in the transportation, mechanical and stores department. In July, 1921, he became a machinist apprentice, in which capacity he served at Hinton, W. Va., and Clifton Forge, Va., until September, 1925, when he became a machinist at Huntington, W. Va. In the following month he was appointed mechanical inspector of lo-

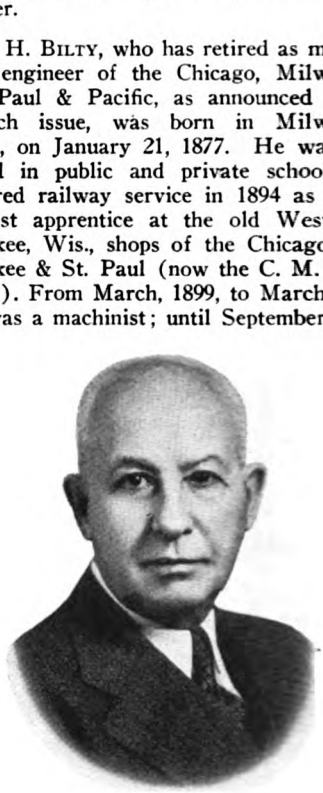


Edgar M. Whanger

comotives and other equipment on the Hocking Valley (part of the C. & O.) at Columbus, Ohio. In September, 1929, Mr. Whanger was assigned to special work for the C. & O., the H. V. and the P. M., with headquarters at Cleveland, Ohio. On February 1, 1930, he was named special representative in the office of the vice-president, maintenance and operation, of the P. M. at Detroit, and was appointed assistant to the vice-president in May, 1937.

J. E. BROWN, whose promotion to superintendent of motive power of the St. Louis Southwestern with headquarters at Pine Bluff, Ark., as announced in the March issue, was born at Andover, Ill., on November 26, 1877, and is a graduate of Washington University, St. Louis, Mo. (1897). He entered railway service on January 1, 1900, with the Kansas City Southern and one year later became a draftsman in the employ of the St. Louis Southwestern at Pine Bluff. On January 1, 1917, he was appointed mechanical engineer; on October 16, 1923, assistant superintendent of motive power, and on February 1, 1943, superintendent of motive power.

C. H. BILTY, who has retired as mechanical engineer of the Chicago, Milwaukee, St. Paul & Pacific, as announced in the March issue, was born in Milwaukee, Wis., on January 21, 1877. He was educated in public and private schools and entered railway service in 1894 as a machinist apprentice at the old West Milwaukee, Wis., shops of the Chicago, Milwaukee & St. Paul (now the C. M. St. P. & P.). From March, 1899, to March, 1900, he was a machinist; until September, 1907,



C. H. Bilty

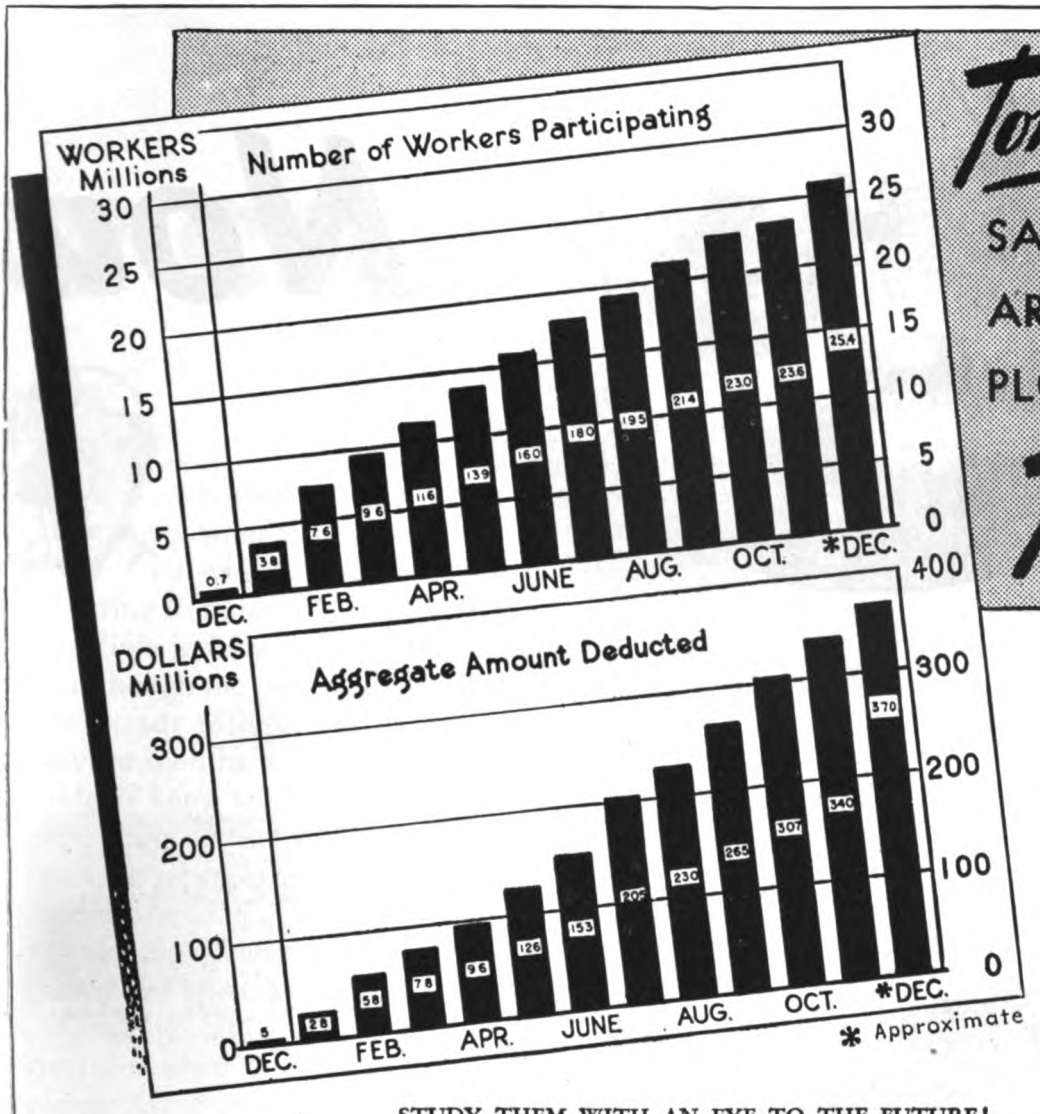
a draftsman, and until April, 1910, chief draftsman. While serving as a draftsman Mr. Bilty attended night school for the study of mathematics. In April, 1910, he became mechanical engineer of the Milwaukee; in April, 1918, was appointed mechanical engineer, Northwestern region, U. S. R. A., and on June 15, 1920, returned to the Milwaukee as mechanical engineer. During the Spanish-American War Mr. Bilty served as an infantry private with the 4th Wisconsin Volunteers. He is a life member of the Association of American Railroads, Mechanical Division, and a member of the American Society of Mechanical Engineers, Western Railway Club, Veteran Employees' Association, and Milwaukee Hiawatha Service Club.

Master Mechanics and Road Foremen

F. L. KING, division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at La Crosse, Wis., has been granted a furlough to enter military service.

H. E. NIKSCH, assistant to the superintendent of motive power of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed division master mechanic, with headquarters at LaCrosse, Wis.

(*Turn to second left-hand page*)



Tomorrow's SALES CURVES ARE BEING PLOTTED . . . Today

THESE CHARTS SHOW ESTIMATED PARTICIPATION IN PAYROLL SAVINGS PLANS FOR WAR SAVINGS BONDS *(Members of Armed Forces Included Starting August 1942)*

STUDY THEM WITH AN EYE TO THE FUTURE!

There is more to these charts than meets the eye. Not seen, but clearly projected into the future, is the sales curve of tomorrow. Here is the thrilling story of over 25,000,000 American workers who are today voluntarily saving close to FOUR AND A HALF BILLION DOLLARS per year in War Bonds through the Payroll Savings Plan.

Think what this money will buy in the way of guns and tanks and planes for Victory today—*and mountains of brand new consumer goods tomorrow.* Remember, too, that War Bond money grows in value every year it is saved, until at maturity it returns $4 for every $3 invested!

Here indeed is a solid foundation for the peace-time business that will follow victory. At the same time, it is a real tribute to the voluntary American way of meeting emergencies that has seen us through every crisis in our history.

But there is still more to be done. As our armed forces continue to press the attack in all quarters of the globe, as war costs mount, so must the record of our savings keep pace.

Clearly, on charts like these, tomorrow's Victory —*and tomorrow's sales curves*—are being plotted today by 50,000,000 Americans who now hold WAR BONDS.

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save with

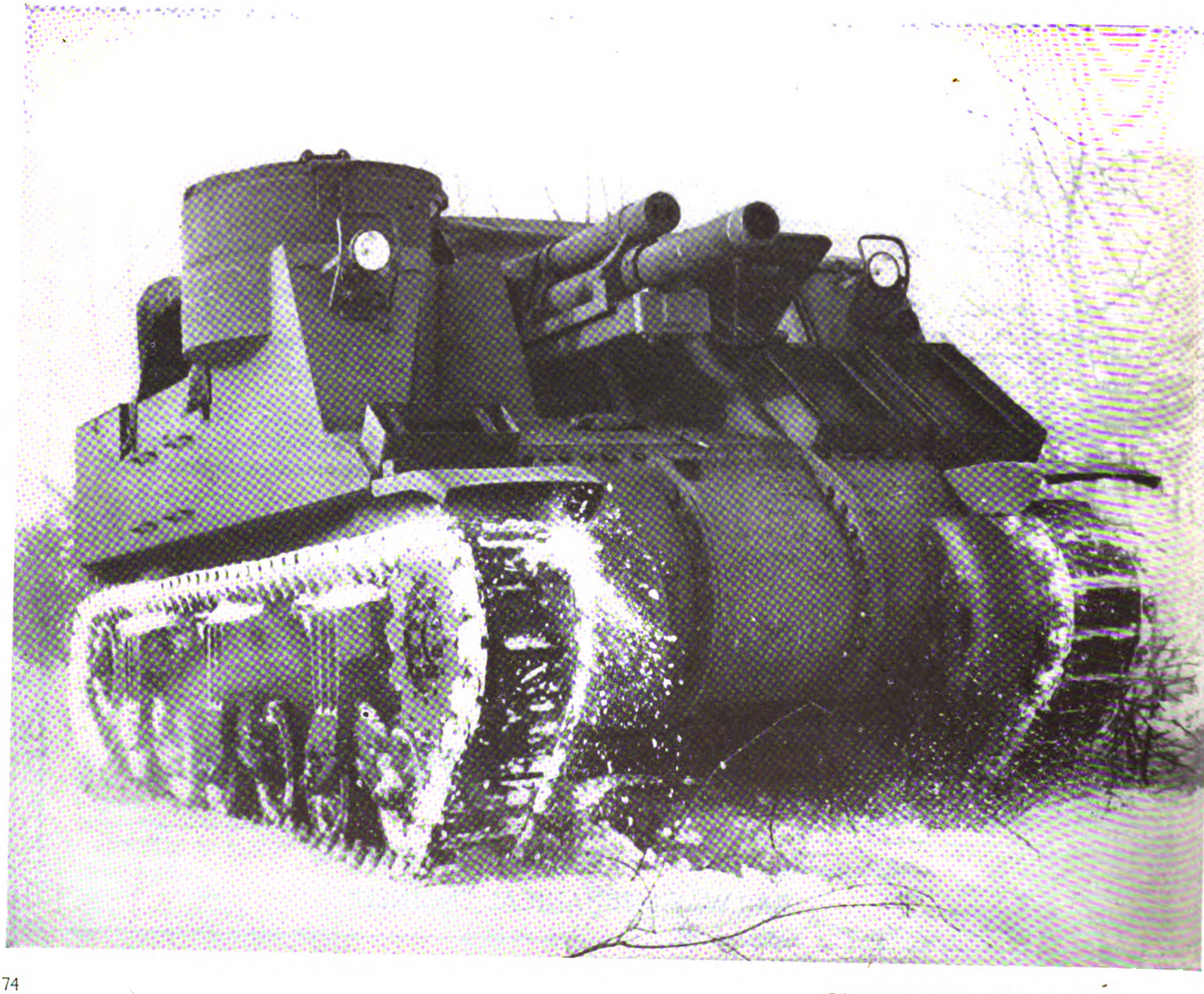
War Savings Bonds

This space is a contribution to America's all-out war effort by

RAILWAY MECHANICAL ENGINEER

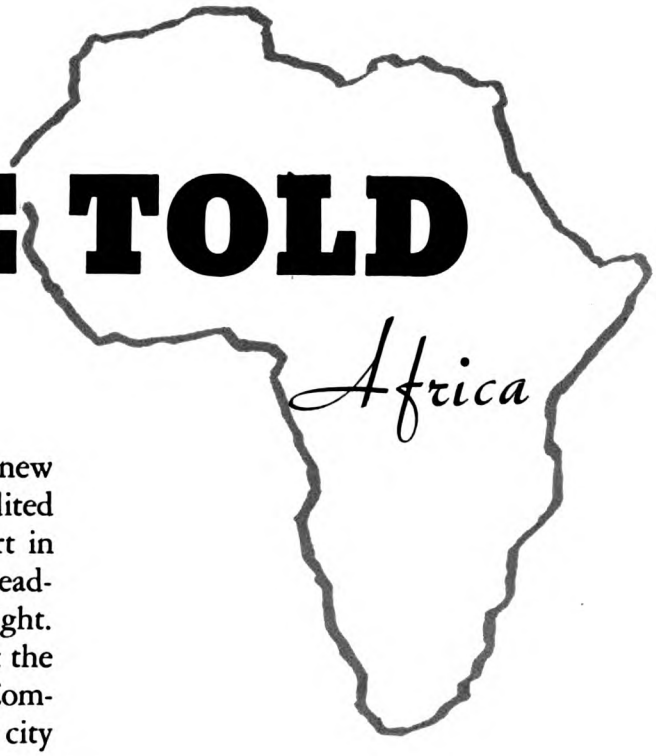


Now



IT CAN BE TOLD





SCHENECTADY—home of the Army's new wonder weapon, the Tank Killer credited with having played an important part in shattering Rommel's Afrika Corps, forcing it into headlong flight in Libya – is again in the national spotlight. Even though the new weapon was in production at the Schenectady plant of the American Locomotive Company for months, and thousands of employees and city residents knew what it was that was being built, not a word about it leaked out to the outside world. As a result, in newspapers throughout the country and on national radio programs, the men at the plant have received high praise and Schenectady itself has become known as "The City That Kept a Secret".

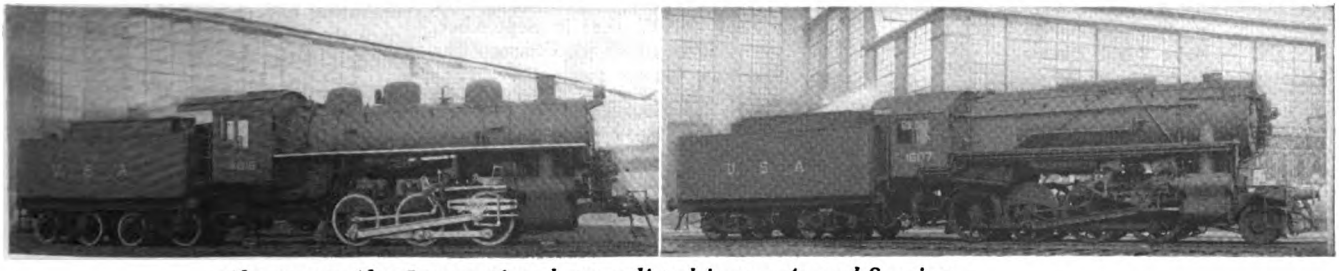
Officially called the M-7, this new weapon was invented when American Army observers with the British Army in Egypt returned to this country with reports of equipment that was needed to stop the Nazi tanks. Army engineers built a wooden model of the weapon they thought would do that, and in March, 1942, American Locomotive engineers were called upon to produce test models. These were built within a few weeks and were successfully tried out by the Army at the Aberdeen Proving Grounds. Since last June M-7's have been rolling out of Schenectady bound for the battle front – *America's answer to Rommel.*



AMERICAN LOCOMOTIVE

Manufacturers of Mobile Power

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, MARINE DIESELS, TANKS, GUN CARRIAGES AND OTHER ORDNANCE



Also many Alco Locomotives have enlisted in our Armed Services

H. S. Roo has been appointed assistant district master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, at Milwaukee, Wis.

FRANK N. BURCH, assistant master mechanic of the Central of Georgia, who has been appointed master mechanic at Macon, Ga., as announced in the March issue, was born on November 28, 1886, at Paducah, Ky. He attended grammar school



Frank N. Burch

and in June, 1902, entered the employ of the Illinois Central at Paducah. After completing his apprenticeship he served on various railroads and in October, 1913, became a machinist in the shops of the Central of Georgia at Macon, and in June, 1917, assistant master mechanic of the Macon, Dublin & Savannah at Macon. He returned to the Central of Georgia in July, 1918, as a machinist, where he later served as machine-shop foreman, erecting-shop foreman and, from June, 1924, until February 1, 1943, as assistant master mechanic.

JOHN DAVID NIMMO, general foreman of the Gulf, Colorado & Santa Fe at Cleburne, Tex., who has been appointed master mechanic of the Gulf division, with headquarters at Silsbee, Tex., as announced in the February issue, was born on March 29,



John David Nimmo

1891, at Topeka, Kan. Mr. Nimmo attended public school at Cleburne and from June 6, 1905, to August 31, 1905, he was employed at tool room boy of the Gulf, Colorado & Santa Fe at Cleburne. He became boilermaker helper at Cleburne on June 9, 1906; machinist apprentice, on April 1, 1907; and machinist on January 18, 1912. He was transferred to Gainesville, Tex., on June 21, 1914 as a machinist and on October 30, 1915, returned to Cleburne as an apprentice instructor. On December 15, 1916, he became assistant day enginehouse foreman at Cleburne and on April 1, 1920, general foreman, locomotive department with the same headquarters. Mr. Nimmo was appointed general enginehouse foreman at Gainesville, Tex., on December 1, 1931, and on February 1, 1939, returned to Cleburne as general foreman, locomotive department. He became master mechanic at Silsbee, Tex., on January 1, 1943.

R. L. TURNER, general foreman of the South shops of the Southern, has been appointed assistant master mechanic, with headquarters as before at Atlanta, Ga.

G. S. GANDY, general foreman, locomotive department, of the St. Louis Southwestern, has been appointed master mechanic, with headquarters at Pine Bluff, Ark.

HARRISON L. PRICE, who has been appointed master mechanic of the Atchison, Topeka & Santa Fe with headquarters at Chanute, Kan., as announced in the March issue, was born on November 27, 1898, at Kearney, Neb. He attended Topeka, Kan., high school, and on February 7, 1916, entered the employ of the Atchison, Topeka



Harrison L. Price

& Santa Fe as a machinist apprentice. After completing his apprenticeship he was a machinist at Topeka, and later at Shopton, Iowa. Mr. Price was appointed apprentice instructor at Shopton in May, 1926. In February, 1929, he again became a machinist and later served as an inspector and on special assignments. In November, 1935, he entered the test department at Topeka, as a test department assistant. In October, 1936, he became night enginehouse foreman at Chillicothe, Mo.; in March, 1937, car foreman and air brake foreman, Empire Car Works, Chicago; in September, 1940, acting superintendent of shops, Chicago Car Works; in September, 1941, superintendent of shops, Chicago Car Works, and now master mechanic.

Car Department

J. W. ZIEHM, former traveling car foreman, who has been serving as general foreman, car department, of the St. Louis Southwestern since July 1, 1942, is now general foreman, car department.

Shop and Enginehouse

V. V. VIOR, enginehouse foreman of the Chesapeake & Ohio at Hinton, W. Va., has been promoted to the position of general foreman at Hinton.

R. A. SCOTT, enginehouse foreman of the St. Louis Southwestern, has been appointed assistant general foreman, with headquarters at Pine Bluff, Ark.

ROBERT MALLEY, a machinist in the employ of the St. Louis Southwestern, at Pine Bluff, Ark., has been promoted to the position of enginehouse foreman.

L. H. CAIN, assistant general foreman, locomotive department, of the St. Louis Southwestern, has been appointed general foreman, with headquarters at Pine Bluff, Ark.

Purchasing and Stores

R. I. RENFREW, assistant general storekeeper of the New York Central at Beech Grove, Ind., has been appointed assistant general supervisor of stores, with headquarters at New York.

C. S. WHITE, general purchasing agent of the New York Central has been appointed manager, purchases and stores, with headquarters as before at New York. The position of general purchasing agent has been abolished.

Trade Publications

Copies of trade pulications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

REVISED STANDARD STEEL ANALYSIS CHART.—American Steel & Wire Company, Sales Promotion and Advertising Department, Rockefeller Building, Cleveland, Ohio. Chart, in folding form, covers carbon and free cutting steels, manganese, nickel, nickel chromium, and molybdenum steels as well as chromium, chromium vanadium, silicon manganese, and National Emergency steels. Embraces all modifications and changes in analyses of AISI, SAE and the new NE steels up to February 1.

◆

CORROSION DATA WORK SHEET.—The International Nickel Company, Technical Service, 67 Wall street, New York. Engineer or executive may utilize this work sheet for requesting information about corrosion problems if he is undertaking a new process involving chemicals or corrosive conditions with which he has not had operating experience; if he wishes to compare the performance to be expected from Monel, nickel, Inconel, or other metals and alloys with materials previously used and found unsatisfactory, or if he cannot get nickel or nickel alloys because of priorities and needs corrosion data on substitute materials. Most practicable data will then be selected from available Inco Technical Service Data and interpreted in the light of the particular needs set forth.

ANDERSON Eitherend

WELDING CABLE CONNECTORS

For convenience in electric welding, Anderson Eitherend cable connectors provide a simple means for coupling together lengths of single conductor cable. Neither male nor female, just insert one connector within the other and the juncture is complete. The ends are exactly alike and no mistake can be made. Eitherend cable connectors have no bolts or other loose parts that take time to adjust.

Thousands in daily use all over the country. Made in cable sizes from No. 6 to N0. 0000. Soldered or solderless connection.



TYPE CC Receptacle. The standard passenger car charging receptacle for many years.

ARMY E NAVY

ALBERT and J.M. ANDERSON MFG. CO.

289-305 A Street, Boston, Mass.

NEW YORK CHICAGO PHILADELPHIA LONDON

No. 9 in a Series of Tips on "Keeping 'em Turning" by Arch Metzgar, 43 years at LeBlond.

I'm Tellin' You...

Eight of my sidekicks here at LeBlond have already given you lathe operators some tips on taking care of your machines. But I'd like to hand out some reminders on how to take care of *yourself*. A lathe really isn't a dangerous machine unless the operator gets careless or forgets one of these common sense rules. A good way to be sure you'll be on the job every day is to remember all of them.



STOP

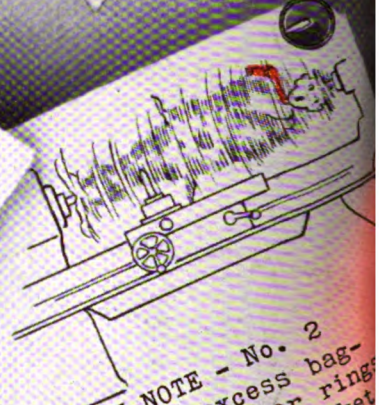
STOP YOUR MACHINE BEFORE YOU -

1. Caliper your work
2. Clean chips from work or tool
3. Oil or wipe machine



FASHION NOTE - No. 1

Save your eyes. They're the only pair you have. Wear goggles when your operation makes the chips fly.



FASHION NOTE - No. 2

Jewelry is excess bag- gage. Don't wear rings wrist watch, or pocket chain. You might get the whirl of things b fore you know it.



HOLD TIGHT

Mount work securely, clamp as close to tool post as possi- ble. Be sure tool is in correct position.



WATCH YOUR STEP

See that the floor around your lathe is always clean. Keep oil wiped up. It's slippery. Don't let chips and shavings pile up. Don't let your mind wander.



FASHION NOTE - No. 3

Don't feature a collegiate drape shape in your work clothes. Wear tight fitting clothes with no tie, or tie tucked in. Roll up your sleeves.

ARMY E NAVY

THE R. K. LeBLOND MACHINE TOOL CO.

CINCINNATI, OHIO

Largest Manufacturer of a Complete Line of Lathes

Transportation Library

May 1943

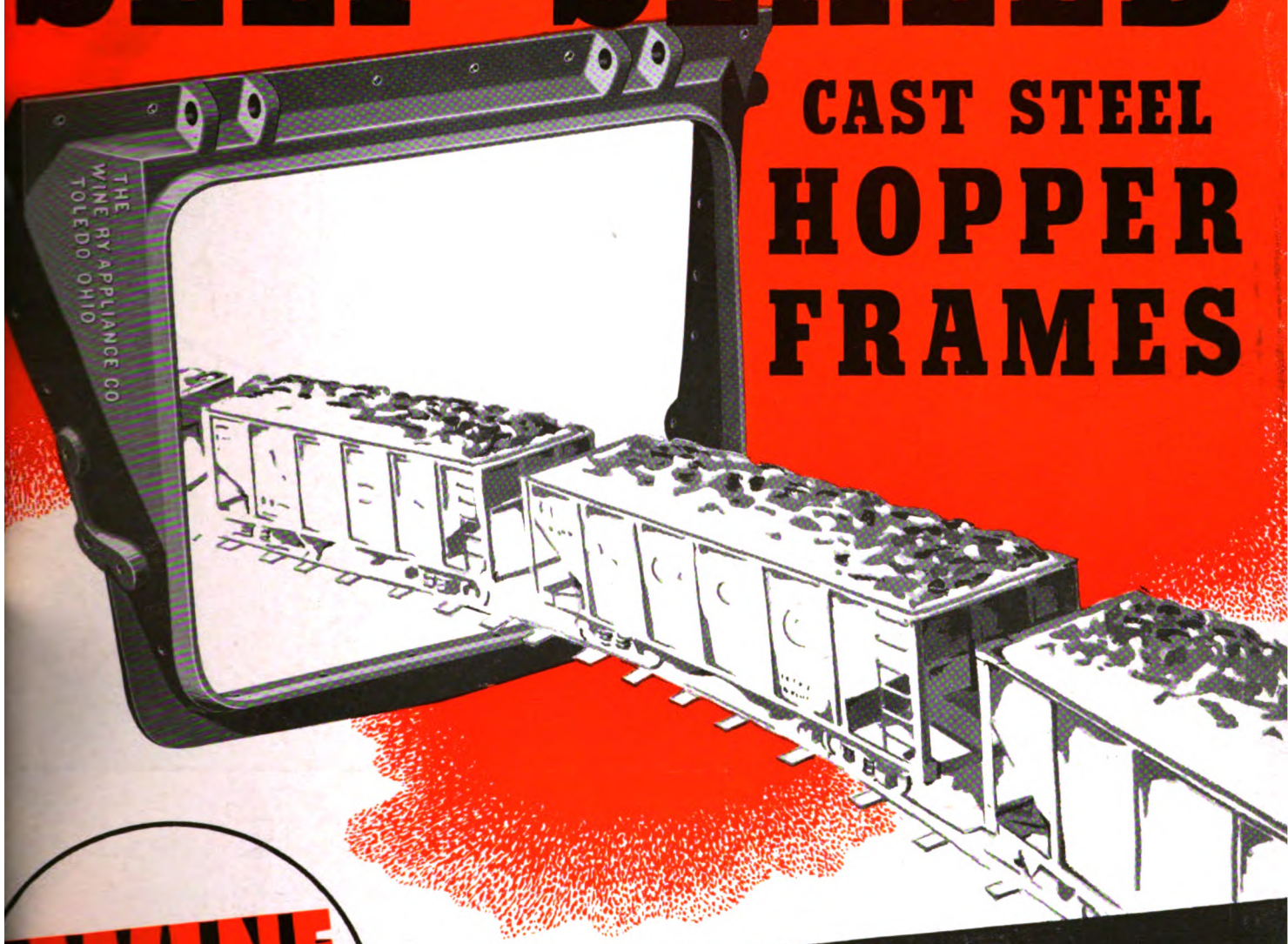
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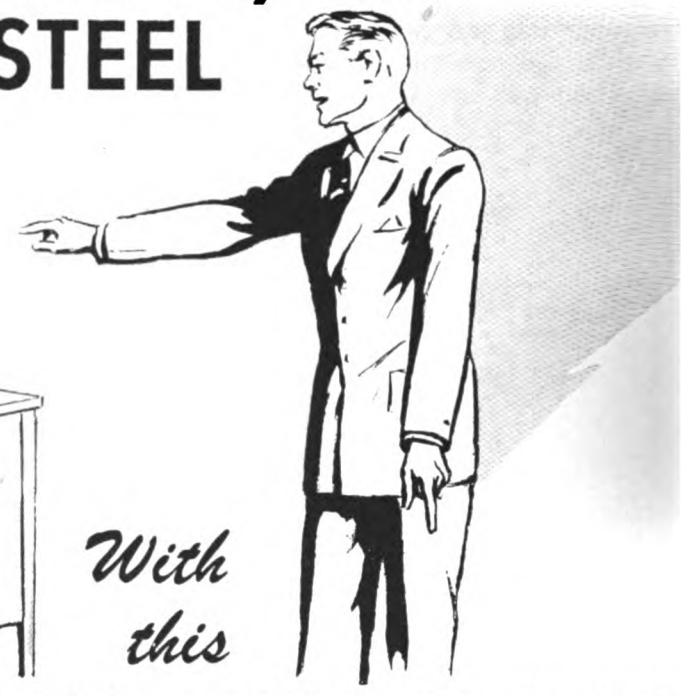
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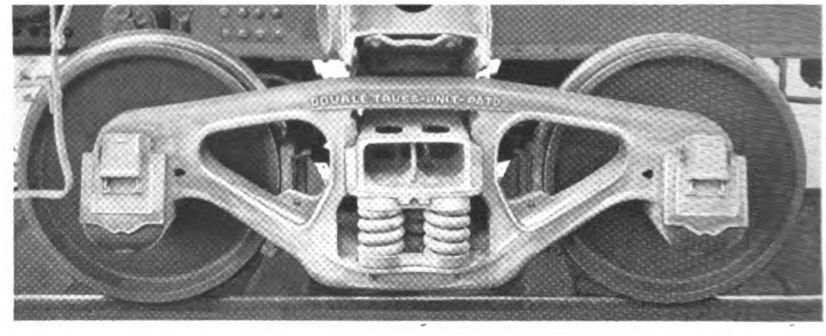
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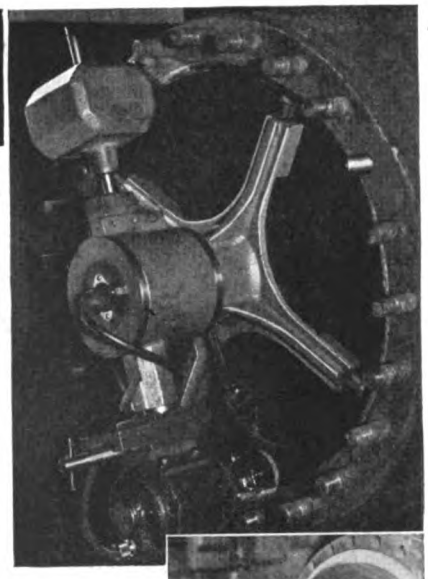
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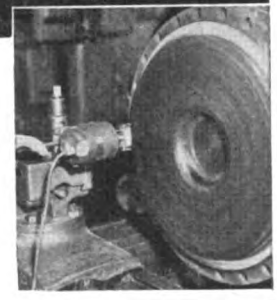


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THE EDITOR'S DESK

SPECTACULAR ACHIEVEMENTS — BUT ?

Many factors have combined to complicate and increase the present difficulties of the railroads. The rubber and oil situation has brought back to them a lot of business, both freight and passenger, that had been carried on the highways. The almost practical elimination of coastwise steamship traffic has made it necessary for the railroads to take on this additional load, much of which consists of long hauls. Instead of freight going by boat, from coast to coast, it has to be taken across the continent by rail. Instead of coal going from the Virginia mines direct to the waterfront and being dumped into ships by special facilities, to be distributed along the coast, it is now transported entirely by rail, in some instances over roundabout and inadequate routes.

The western railways have had to revolutionize their practices to accommodate the extremely heavy movement of freight and passengers to west coast ports—ports and facilities, by the way, that were never intended to handle so heavy a traffic.

These are only typical of some of the new and unusual demands that have been made upon the railroads. Summing up, the number of tons of freight hauled one mile in 1942 was almost double that in 1939, and almost half again as much as in 1918, the peak year in the first World War. Passenger traffic, measured by the number of passengers carried one mile in 1942, was two and one-third times what it was in 1939 and about one-quarter again as much as in 1918. Rail traffic is still growing. It is estimated that the increase in freight business in 1943 over 1942 will be about 10 per cent and that for passenger traffic about 25 per cent.

It would take a book to do justice to the ways and means by which this remarkable performance of the railways is being accomplished. Moreover, it is being done at a time when the railroads are not being shown any particular consideration by the selective service draft boards. They have also lost many capable executives and supervisors who were not subject to the selective service draft, but volunteered to help build up the Military Railway Service, some parts of which are already giving a splendid account of themselves in supporting our troops on various fronts.

There are now actually 25 per cent less freight cars than in 1918, and almost 30 per cent fewer passenger-train cars. There are about 34 per cent less locomotives, although measured in terms of tractive force, the deficiency is only about eight or nine per cent. With less equipment and much greater traffic than in 1918, the railroads are carrying on without congestion, but this is being accomplished only by almost superhuman efforts on the part of the men and management, and splendid co-operation from the shipping and traveling public.

The danger is that because they have staged such a spectacular performance the authorities may fail to realize the fact that they are reaching the top limit of capacity. They must carry on!

Roy V. Wright

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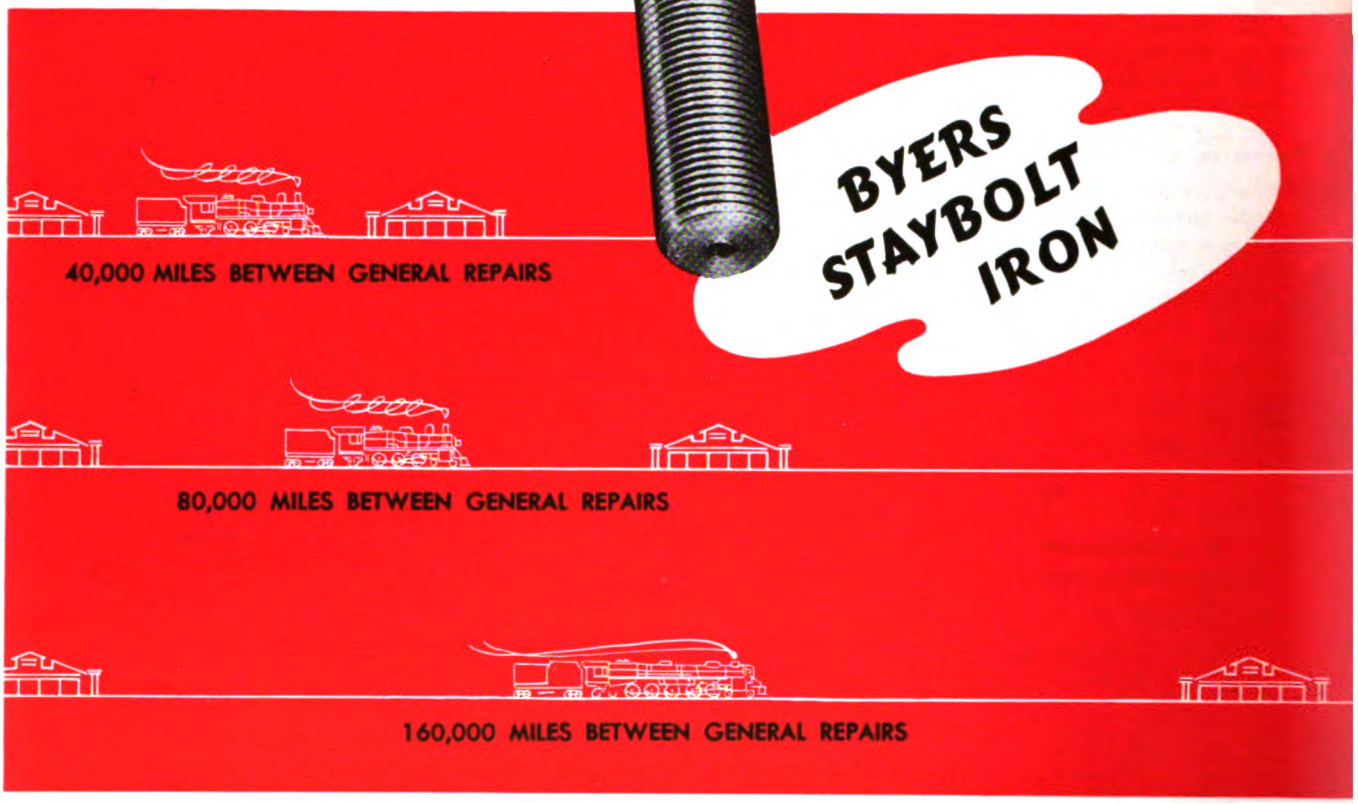
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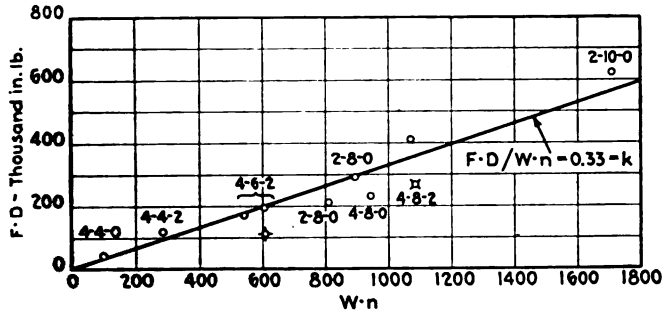
RAILWAY
MECHANICAL ENGINEER

Locomotive Machine Friction

By Lawford H. Fry*

A general expression is derived from a study of experimental data from over 375 individual test-plant runs

THE purpose of this article is to obtain a general expression for the machine friction of a steam locomotive. The experimental data is taken from locomotive testing-plant reports for the eleven locomotives listed in Table 1. The data is from tests made on the plants at Purdue, at the University of Illinois and at the Altoona plant of the Pennsylvania. A wide variety of designs and sizes are covered, ranging from Goss's 4-4-0 type locomotive



F × D = friction torque = friction drawbar pull × driving-wheel diameter
W × n = effective weight on drivers = weight on drivers × number of group coupled axles

Fig. 1—Relation between friction torque and effective weight on drivers

with 61,000 lb. on drivers to the Pennsylvania Class IIs, 2-10-0 type with 342,000 lb. on drivers. Friction values for over 375 individual test runs have been plotted.

From this mass of experimental data it is concluded that the machine friction is related to the number of coupled axles, the total weight on drivers and the driving-wheel diameter by the equation

$$F = \frac{0.33\ n \cdot W}{D} \qquad (1)$$

Where

n = the number of driving axles coupled in a group
W = the weight on all driving wheels in pounds
D = the driving-wheel diameter in inches
F = the machine friction in pounds of drawbar pull

This equation indicates that with four driving axles carrying a given adhesive weight the machine friction with all drivers coupled will be twice that which will be found if the axles are coupled in two pairs. In the first case, n, the number of group-coupled axles is four, in the latter case, two.

In the case of each locomotive studied comparison of the computed with the measured friction shows no greater deviation than is found among the measured values themselves.

* Railway engineer, Edgewater Steel Company, Pittsburgh, Pa.

The experimental data is plotted in Figs. 1 to 11. In Figs. 2 through 11, the observed friction drawbar pull is plotted against the total measured drawbar pull. Each point is marked to indicate the speed at which the test was run. In a series of tests at one speed it is evident that an increase in drawbar pull must correspond to an increase in cut-off. The plots therefore serve to show

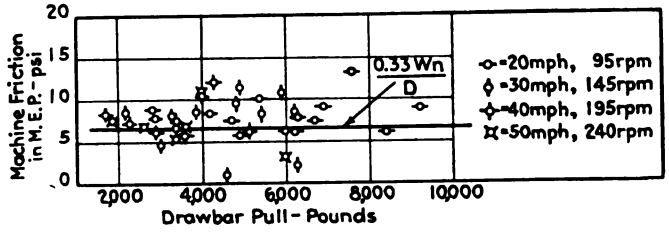


Fig. 2—Purdue 4-4-0, No. 2—Superheated

the effect, if any, that speed and cut-off have on the value of the machine friction. Through each plot a horizontal line is drawn corresponding to the value of the machine friction derived from the application of equation (1).

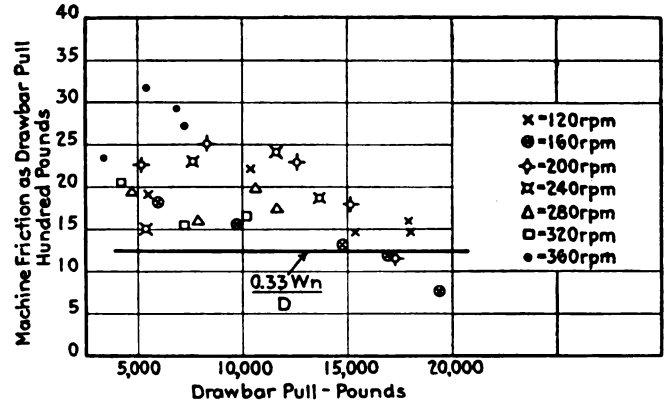


Fig. 3—Pennsylvania 4-4-2, Class E6s No. 51—Bulletin No. 27

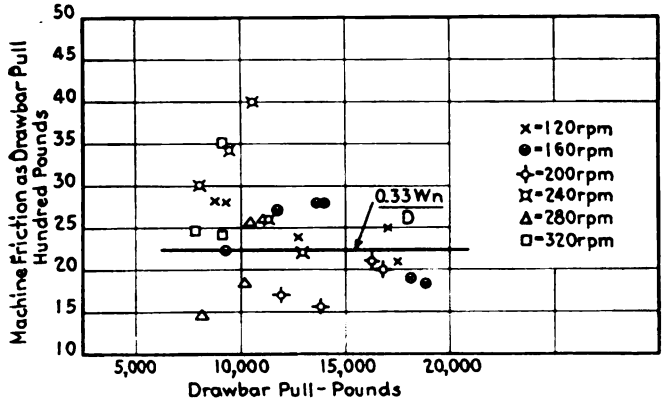


Fig. 4—Pennsylvania 4-6-2, Class K2s No. 877—Bulletin No. 18

From these ten plots it is concluded that:

1—Precise measurement of the machine friction of a locomotive is difficult. In every plot the individually measured points deviate from their mean value by at least 50 per cent of that value.

2—There is no indication that the machine friction is affected by the speed.

3—In the majority of the test groups there is no systematic change in machine friction as the drawbar pull is changed by changing the cut-off. That is to say, in the majority of the plots the points for the individual tests group themselves about a horizontal line.

4—In the majority of cases the lines drawn from equation (1) represent the individual tests reasonably well.

Careful consideration of all evidence available has led

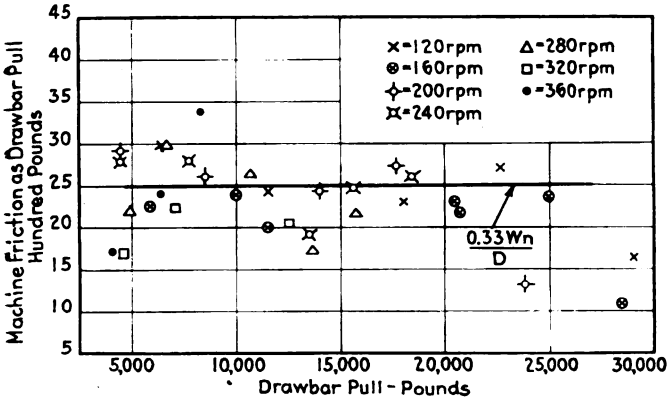


Fig. 5—Pennsylvania 4-6-2, Class K4s No. 1737—Bulletin No. 29

to the foregoing conclusions, but some details of the plots deserve discussion.

In the majority of the plots the individual points show no change in machine friction as the drawbar pull increases. In one case, however (Fig. 10), there is a tendency for the machine friction to drop as the drawbar pull is increased. Two other cases (Figs. 6 and 11) show a reverse effect, the tendency being for the machine friction to rise as the drawbar pull is increased. It is believed that these variations from the horizontal are accidental. In Fig. 4 the omission of four or five tests at low rates of drawbar pull would level off the plot.

Figs. 6 and 11 showing a tendency for friction to rise as drawbar pull is increased represent, respectively, a 2-8-0 locomotive on the University of Illinois plant and a 2-10-0 locomotive on the Altoona plant. The tests of the 2-8-0, 2-8-2 and 4-8-2 locomotives represented by Figs. 7, 8, 9 and 10 indicate that this rise in friction with increasing drawbar pull is not typical.

The very large deviation shown in all of the test groups expresses the difficulty of measuring the machine friction with any high degree of precision. It cannot be measured directly but is found by determining the indicated cylinder tractive force and deducting from this the drawbar pull measured by the dynamometer. The resulting difference is small compared with the measured quantities. If the friction represents 15 per cent of the drawbar pull an uncertainty of 3 per cent in the indicator cards will mean an uncertainty of 20 per cent in the friction. Indicator cards are not likely to be more precise than this and at least a similar lack of precision must be counted on for the dynamometer. Therefore even under

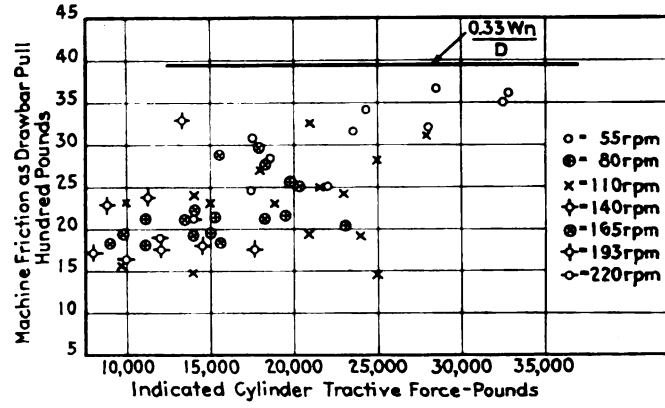


Fig. 6—Illinois University 2-8-0—Bulletin No. 82

favorable conditions an uncertainty of 40 per cent in the value of the friction will be normal.

Form of the Equation

The form chosen for Equation (1) is based on the following considerations:

1—The value of the friction drawbar pull must bear some relation to the size of the locomotive, or more directly to the dimensions of cylinders and machinery parts. It is believed that this size effect can be taken into account with reasonable accuracy by assuming that there is direct proportionality to the total weight on driving wheels.

2—The experimental data shows that the friction drawbar pull increases more rapidly than the weight on drivers. It is thought that this can be taken into account by assuming direct proportionality to the number of coupled wheels.

3—The frictional resistance to movement of the machinery originates at the circumference of the driving journals, at the crank pins and in the reciprocating parts

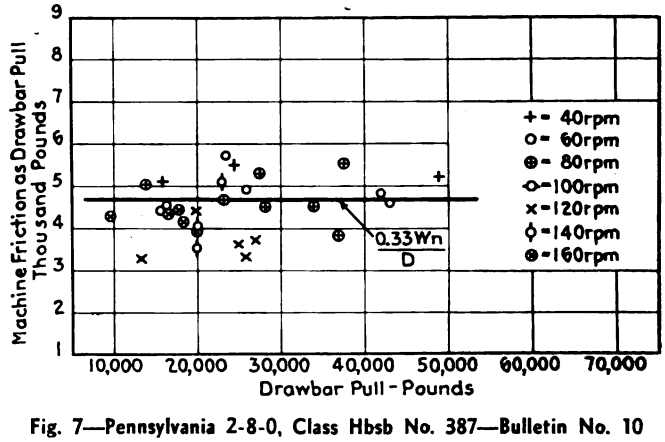


Fig. 7—Pennsylvania 2-8-0, Class Hbsb No. 387—Bulletin No. 10

attached to the crank pins. This resistance is translated into drawbar pull through the leverage of the driving wheel radius. It is therefore reasonable to assume that the friction drawbar pull is inversely proportional to the driving wheel diameter. It might be argued that the driving journal diameters and the stroke should be brought into account. This may be theoretically true, but the experimental data is not precise enough to justify an attempt in this direction.

Derivation of the Equation

Having assumed that the machine friction could be expressed by an expression of the form of equation (1),

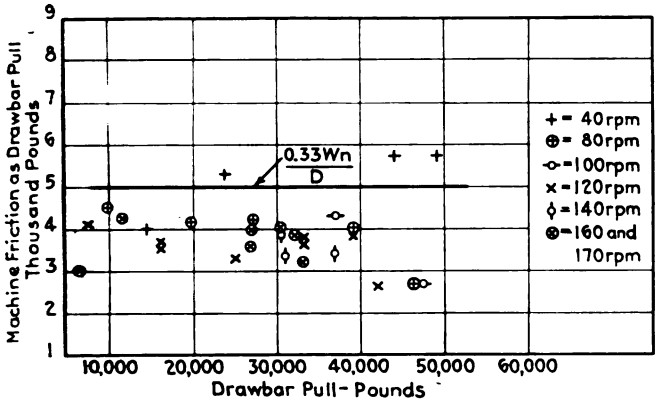


Fig. 8—Pennsylvania 2-8-2, Class Lls No. 1752—Bulletin No. 28

the ten plots, Figs. 2 to 11, were used to determine the value of the numerical coefficient. If this coefficient is represented by k, Equation (1) becomes

$$F = \frac{k \cdot n \cdot W}{D} \quad \text{.....(1a)}$$

$$k = \frac{F \cdot D}{n \cdot W} \quad \text{.....(2)}$$

In each graph a value was selected for representative of the plotted values of the friction which correspond to the

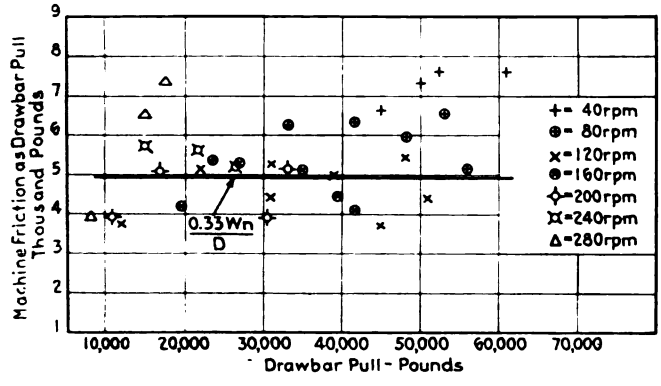


Fig. 9—Pennsylvania 4-8-2, Class M1 No. 6872—Test report June 6, 1929

normal working drawbar pull of the locomotive. These values of F are given in column 7 of Table 1. From these figures values of k were computed by Equation (2). These values are given in column 8. The average of the ten values thus found for k is 0.330 and this value has been used in Equation (1).

As a further check, Fig. 1 was plotted. Ordinates represent the values of F derived from the plots (Col. 7, Table 1), multiplied by the driving-wheel diameter. This product represents the torque lost in friction. Abscissae are the values obtained by multiplying the weight on drivers by the number of axles coupled in a group. If the relation of Equation (1) is true, the values plotted in

Table I—Dimensions of Locomotives

1	2	3	4	5	6	7	8	9
			Loco-Motive		Driv.	From plot		$F = 0.33 \pi W$
Fig.	Loco. type	Test plant	desig-nation	Wt. on drivers, lb.	whl. dia., in.	F	k	D
2	4-4-0	Purdue	No. 2	61000	69	580	0.327	585
3	4-4-2	Altoona	E6s No. 51	101000	80	1500	0.425	1260
4	4-6-2	Altoona	K2s No. 877	180000	80	2250	0.333	2230
5	4-6-2	Altoona	K4s No. 1737	203000	80	2400	0.315	2500
6	2-8-0	U. of Ill.	.....	201000	63	3400	0.266	3900
7	2-8-0	Altoona	H8bs No. 387	219000	62	4700	0.334	4650
8	2-8-2	Altoona	L1s No. 1752	236000	62	3700	0.243	5000
9	4-8-2	Altoona	M1 No. 6872	267000	72	5700	0.386	4900
10	4-8-2	Altoona	M1a No. 6706	271000	72	3700	0.247	4950
11	2-10-0	Altoona	I1s No. 790	342000	62	10000	0.362	9100
			Average				0.330	

Fig. 1 should fall on a straight line having the slope 0.33. It will be seen that this line gives a conservative representation of the plotted points.

In studying existing reports of measurements of loco-

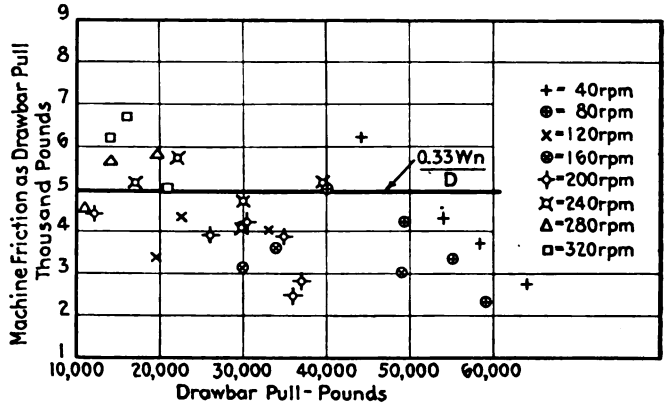


Fig. 10—Pennsylvania 4-8-2, Class M1a No. 6706—Test report March 8, 1932

motive machine friction it must be understood that an individual measurement may not have a high degree of precision. It is believed, however, that the large mass

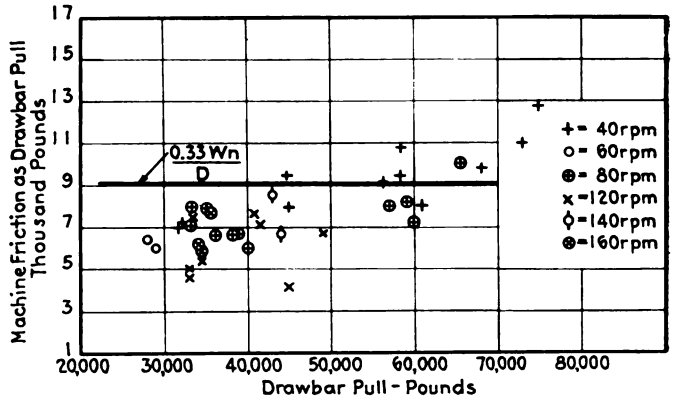


Fig. 11—Pennsylvania 2-10-0, Class I1s No. 790—Bulletin No. 31

of data considered provides reasonably accurate figures as to the friction which may be expected in any given locomotive.

Acknowledgment is made of the courtesy of H. W. Jones, chief of motive power, Pennsylvania, for permitting the use of data from the Altoona locomotive testing plant.

Diesel or Steam Power?

By L. K. Sillcox*

An amplification of many of the more important points brought out in a paper and discussion before the Institution of Locomotive Engineers, London

IN THE January, 1943, issue of *Railway Mechanical Engineer,* page 29, appeared an abstract of a paper by Mr. Sillcox presented before the Institution of Locomotive Engineers, London, England. The paper brought forth considerable discussion, largely in the form of questions soliciting the amplification of numerous points. The information contained in the author's closure is of such general interest that it is presented herewith, in abstract. The author, in stating why the information is offered, makes the nature of the question obvious.—EDITOR.

Derivation of Locomotive Data

A question has been raised relative to the manner in which the horsepower values presented were obtained, which are, incidentally, sustained. They are the result of road tests with dynamometer car, the measured readings being corrected for grade and acceleration where necessary. In the case of Fig. 4†, where driver horsepower and tractive force values are shown, it was also necessary to include locomotive resistance. The rapid decrease in horsepower at high speed exhibited by the modern steam locomotive of Fig. 1 (built in 1938 and less than two years old at time of tests) is chargeable to the low mean effective pressure obtaining and would indicate the desirability of improved valve and valve gear design. The steam locomotive of Fig. 4 does not exhibit this weakness to such a marked degree. In this connection, it is a misnomer to designate a Diesel locomotive by its engine horsepower in that the locomotive itself cannot develop that horsepower at any speed. However, that fact is clearly appreciated and such method of designation provides a convenient and uniform basis for a nominal rating.

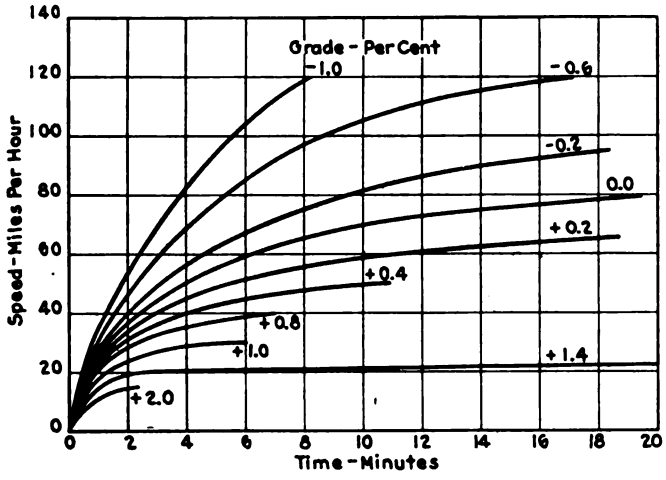


Fig. 6—Speed-time curves for 4,000-hp. Diesel-electric passenger locomotive hauling 1,250-ton train on various grades

While the locomotives whose tractive force and horsepower characteristics are graphically presented in Fig. 1 and those whose accelerating characteristics are likewise illustrated in Fig. 3 are very similar, they are different units operating on two railways. Especially close is this similarity in the case of the Diesel-electric locomotives due to the tendency of standardization in Diesel manufacture. The steam locomotive of Fig. 3 is not booster-equipped.

The railway submitting Fig. 4 explains that the tractive force curve of the Diesel-electric is driver tractive force while that of the steam locomotive is that obtaining at the cylinders inasmuch as that is standard practice on that system.

Weight Comparison of Steam and Diesel-Electric Locomotives

4-8-4 STEAM LOCOMOTIVE

Weight on drivers, lb.	270,000
Total engine, lb.	483,000
Tender, lb.	406,500
Total, lb.	889,500

5,400-HP. DIESEL ELECTRIC

24,690 lb. ea. on 24 driving wheels =	592,560 lb.
23,730 lb. ea. on 12 idle wheels =	284,760 lb.
Total	877,320 lb.

The relative weights of the locomotives of Fig. 4 are compared in the table. The Diesel-electric locomotive has over twice the adhesive weight of the steam unit. Also,

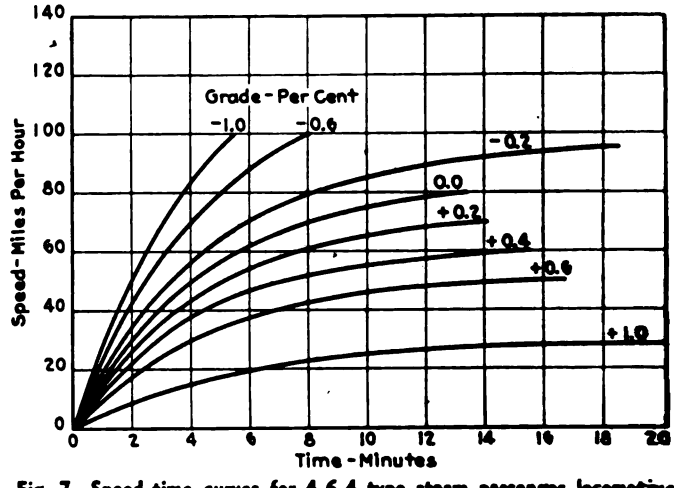


Fig. 7—Speed-time curves for 4-6-4 type steam passenger locomotive hauling 1,250-ton train on various grades—Locomotive tractive force 49,500 lb.; weight on drivers 213,440 lb.

* First vice-president, New York Air Brake Company.

† Figs. 1 to 5 inclusive appeared in the January, 1943 issue and to avoid confusion the charts accompanying this article are numbered Figs. 6 to 12, inclusive.—EDITOR.

since it can support a higher adhesion factor due to its more even torque, this advantage is still further enhanced.

Steam Helpers on Diesel Powered Trains

In so far as steam helpers on Diesel-powered trains are concerned, the condition is no different from that obtaining if a steam locomotive were assigned to the service. It is as uneconomical to power a train sufficiently to enable traversing the steep grades of the Rocky or Allegheny Mountains with one type motive power as another. Trains operating from Chicago to the Pacific Coast or via the southern route from New York to Chicago encounter difficult grades for comparatively short distances with much level or rolling territory throughout the remainder of the runs. In such instances we observe the apparently incongruous spectacle of a steam locomotive at the head of a Diesel-powered train on ruling grades without considering that possibly two helpers would have been required if steam power were employed exclusively.

Load Factor of Diesel Powered Trains

Information has been requested relative to the load factor of Diesel-powered trains and to the center of gravity of those trains. The table presents representative data in reply to both. Some of the preceding train consists have been revised, both in respect to number of cars and installed horsepower, since the above were obtained but the load factor has not changed materially.

Data on Diesel Load Factors and Centers of Gravity

Train Name	No. of cars	Total train wt., tons	Total hp.	Lb. per hp.	Center of gravity, in. Power unit	Cars
City of Los Angeles, No. 1	11	665	4,000	333	52	49
Twin City Zephyr	7	380	1,800	422	57	52
Super Chief	9	796	3,600	442	57	55
City of Portland	8	468	2,100	446	52	49
City of Los Angeles, No. 2	14	1,256	5,400	465	57	55
City of San Francisco	14	1,273	5,400	472	57	55
Sam Houston Zephyr	4	144	600	480	52.5	48
Pioneer Zephyr	4	151	600	503	52.5	48
Golden Gate	6	456	1,800	507	57	55
Denver Zephyr	12	782	3,000	521	57	52
General Pershing Zephyr	4	270	1,000	540	52.5	48
San Diegan	7	500	1,800	555	57	55
City of Denver	11	729	2,400	608	52	52.5
Average	..	....	....	484	54.8	51.8

The centers of gravity of standard equipment vary somewhat but 56 inches and 78 inches are typical values for passenger cars and steam locomotives, respectively.

Calculation of Tractive Force Curves

The tractive force curves of Fig. 5 are those used by a company considering Dieselizing one of its yards and were taken from the study prepared in that connection. Obviously, the steam locomotive curves are calculated by some formula which compensates for the effect of speed other than the conventional speed factor. In so far as adhesive limits are concerned, steam locomotives are ordinarily designed to produce a maximum tractive force which will be supported by a 25 per cent coefficient of adhesion while, due to the more even torque, the corresponding value for a Diesel-electric is assumed to be 30 per cent, and upon this percentage the rated tractive force is determined. This is true in the case in question. In this instance the steam locomotives could not exert a tractive force equal to 25 per cent of weight on drivers, the tractive force being calculated from the common equation,

$$T = \frac{0.85\ Pd^2s}{D}$$

where

P = boiler pressure, lb. per sq. in.
0.85 P = assumed cylinder pressure, lb. per sq. in.
d = cylinder diameter, in.
s = stroke, in.
D = diameter of drivers, in.

The author does not feel that the higher acceleration possible with a Diesel-electric switching locomotive is an

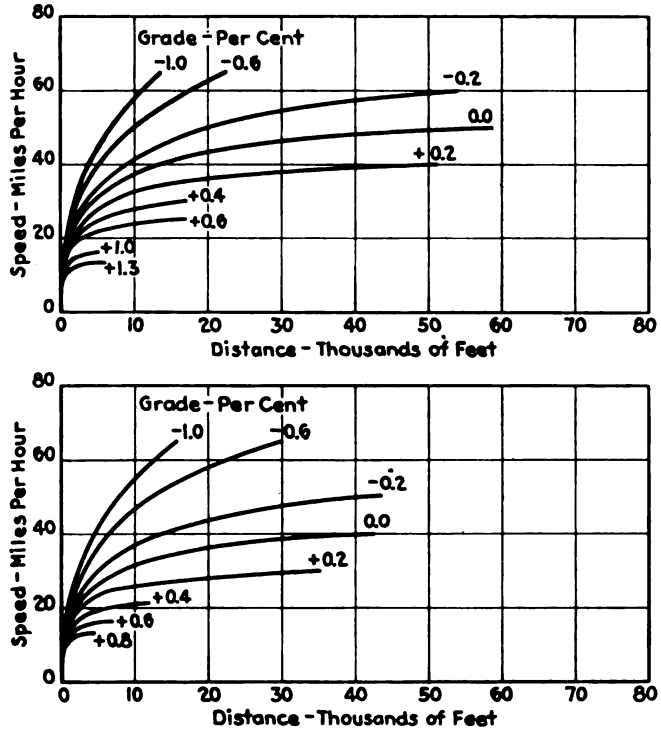


Fig. 8—Speed-distance curves showing the distance required to accelerate a 4,000-ton freight train—(Top chart) hauled by a 5,400-hp. Diesel-electric freight locomotive on various grades; lower chart shows similar curves for a 6,000-ton train

inherent source of damage to cars or their lading. The constant torque displayed by the Diesel provides smooth uniform acceleration, free from the fluctuating force of the steam locomotive, and thus it is less damaging to draft gear. In so far as damage from impact upon release is concerned, it appears that the judgment of the engineman must be relied upon irrespective of power type. The advantage exhibited by the Diesel is in attaining a given speed more quickly, not in attaining a higher speed than that of its steam counterpart. Uncoupling speed need not vary with power type.

Operating Mileages of Freight and Passenger Runs

The high average annual mileages of 250,000 and 180,000 indicated for the passenger Diesel-electric and steam locomotives, respectively, are not indicative of the general average in the United States since Diesel-electrics are assigned mainly to runs of considerable length, such as Chicago to the Pacific Coast, and the mileages accumulated by steam locomotives in the same services were selected for comparative purposes. A western transcontinental railway, the A. T. & S. F., has released selected steam locomotive utilization data which are of interest.

A. T. & S. F. Steam Locomotive Mileage for July, 1942—Through Service

Passenger:	
Average, total	9,928
Individual run, maximum	15,382
Individual locomotive, maximum	20,290
Freight:	
Average, total	6,166
Individual run, maximum	9,015
Individual locomotive, maximum	10,397

While steam switching locomotives are assigned, in so far as traffic conditions will permit, to 24 hour continuous periods of duty, the system utilization is but approximately 67 per cent. It should be added here that it is the "practice to give preference to the use of Diesel locomotives when both steam and Diesel power are assigned, in order to get maximum utilization of the Diesels, resulting in some loss of mileage to steam locomotives." The result is a utilization of 92 per cent for Diesel switching power. Rarely is the attempt made in this country to operate a steam switching locomotive over 24 hours without return to the enginehouse and many railways prefer the 16-hour maximum. The tendency toward longer periods of activity is increasing, however, and the higher maximum is becoming more frequently respected.

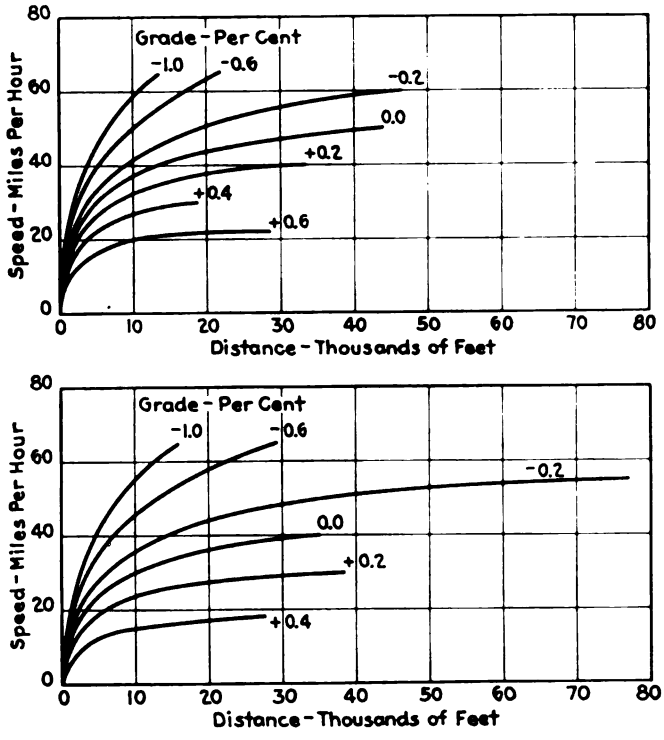


Fig. 9—Speed-distance curves for a 2-10-4 type steam freight locomotive having a tractive force of 93,000 lb. and a weight on drivers of 371,990 lb.—The upper chart shows the distances required to accelerate a 4,000-ton train and the lower chart is for a 6,000-ton train

A Definition of Availability

Availability as used in the paper is defined as the percentage of total time the unit is available for service, while utilization is the percentage of the total time it is assigned to duty. For example, if a switching locomotive is assigned to but two of the three eight-hour shifts per day and four hours are required for servicing and light repair, that unit's availability would be 83.3 per cent but its utilization would be but 66.7 per cent through no fault of the locomotive.

Why Not Mechanical Transmissions?

A major reason that the mechanical transmission has not been more popular in the United States is the large power units in operation. Mechanical transmission has been applied successfully to light rail cars but the high stresses in gear trains associated with road units have discouraged its use. While electric transmission is high in first cost and relatively heavy, its adaptability lends itself to freedom in layout and is excellently suited for the remote control necessary for multiple unit operation. Dynamic braking in descending long grades, obtained with electric transmission, is a distinct advantage in mountainous territory and results in a reduction in wheel and brake shoe wear, and wheel damage, due to lessening the demands upon the air brake system. The practice of nose suspending traction motors on Diesel locomotive trucks does lower the center of gravity from the height which it would occupy if flexible drives were employed and higher lateral rail stresses are a consequence. However, it is judged that the advantages of the low center of gravity fully compensate for this detrimental feature. Here again the high power values to be transmitted in the large units employed operate to the disadvantage of flexible drive mechanisms although, admittedly, they exhibit beneficial characteristics. The bogie type truck with traction motors mounted thereon is preferred in this country in that the center of gravity is maintained lower than could be possible with quill drive and, as the motors would be mounted high, they would interfere with equipment and accessory space in the cab. The present design also permits a truck to be removed as a unit and another substituted quickly for maintenance with a mini-

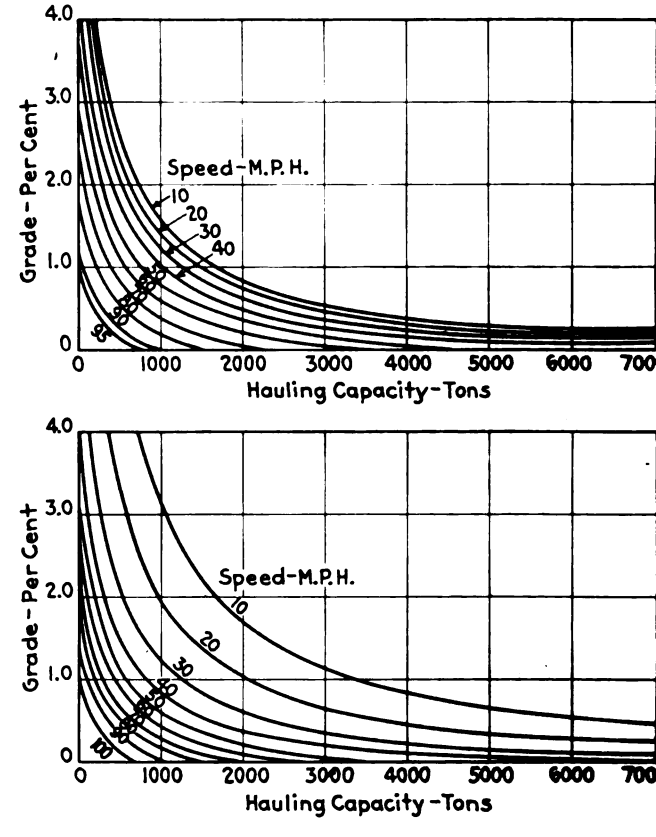


Fig. 10—Hauling capacity curves for trains consisting of 90-ton cars. The upper chart shows a group of curves for a 4-6-4 type steam passenger locomotive having a tractive force of 49,500 lb. and weight on drivers of 213,440 lb.; the lower chart shows similar curves for a 4,000 hp. Diesel-electric passenger locomotive having a tractive force of 107,850 lb. and a weight on drivers of 422,100 lb.

mum delay. Furthermore, the independent bogie trucks restrict the rigid wheel base to that of a four- or six-wheel truck.

Operating Costs and Mechanical Failures

The locomotive labor costs were submitted as complete. As previously stated, all railways do not carry a third man, maintainer, on their Diesel-electric locomotives and, when done, it is customary practice either to carry this cost in a separate account or to add it to maintenance labor. There is one disconcerting factor which is difficult of evaluation and that is the practice of manufacturer's representatives riding the Diesel-electric units, especially when new or when a railway is just initiating the new power type, without cost to the railway. This factor vanishes however as the railway maintenance force becomes trained or the Diesel unit accumulates mileage. In so far as maintenance en route, only minor inspection and repairs can be thus accomplished. Railways which observe the practice of providing a member of the maintenance force on all Diesel runs feel the expense is justified in that it is insurance against road failures and reduces terminal maintenance time since the maintainer is fully aware of what repair or inspection is necessary and the work can be initiated without delay. Difficulty has not been experienced in this country in obtaining qualified enginemen for assignment to Diesel-electric operation, but a short period of training being necessary. As stated, practice of carrying maintainers is not universal and, when not carried, the operator, or his "fireman," must service the equipment en route, hence the training is necessarily more extended. In some instances, labor union agreements or state laws preclude dispensing with the "fireman" and in such cases no labor saving accrues from this source. This statement, of course, applies only to yard service. The "fireman" is never dispensed with in road service.

It is true that special facilities are required for Diesel locomotive maintenance and that the duplication has increased costs. This question involves the opposing views as expressed during the discussion. One view is that, with the two types of motive power, duplicate facilities are required—that steam maintenance and servicing equipment must be maintained as long as any steam power remains—and that the savings accruing to Diesel-electric power are therefore materially reduced. This cannot be denied. The opposing view is that in most parts of the world the Diesel can only be complementary to steam or electric systems and full Dieselization is impossible. Speaking only for the United States, there is no inherent reason why the Diesel-electric cannot produce all the transportation on selected railways. However, in the middle of the traffic scale where a unit can be utilized for but 8 to 12 hours per day, overhead costs will overcome operating savings and, in this case, the economic study would necessarily be section-wide or system-wide in scope. Obviously, each individual case would present its own peculiar problems and would require close study before a decision could be rendered.

The claimed Diesel advantage of eliminating the monthly boiler wash mandatory with steam power was challenged during the discussion on the basis that cylinder maintenance is an offsetting factor. Illustrative of experience in this country, one railway removes and reconditions for reapplication Diesel engine cylinder liners when worn 0.020 in. every 325,000 miles, or, on the basis of an average annual mileage of 250,000, every 15.6 months. Cylinder heads are reconditioned every 100,000 miles or 4.8 months. This same railway reports it is obtaining approximately 84,000 miles between machining of truck wheels—slightly over four months of operation—for a total service life of about 250,000 miles.

One analysis of Diesel-engine part failures developed the percentages shown in the table.

Analysis of Part Failures of Diesel Engines

Name of Part	Percentage of failures: Of each part	Cumulative
Bearings	30.0	30.0
Cylinders (including heads and liners)	24.3	54.3
Pistons and piston rings	15.3	69.6
Valves	7.3	76.9
Crankshafts	4.5	81.4
Connecting rods and crankbolts	4.5	85.9
Gears	4.5	90.4
Fuel pumps and piping	2.8	93.2
Governor parts	2.8	96.0
Exhaust manifolds	2.3	98.3
Miscellaneous	1.7	100.0

Cost of Steam Locomotive Repairs Per Horsepower Unit*

(Based upon 10,983 locomotives and 26,401 locomotive repair years)

Year of age	Cost per hp. unit	Year of age	Cost per hp. unit
1	$.430	26	$1.572
2	.720	27	1.603
3	.868	28	1.634
4	.899	29	1.664
5	.930	30	1.695
6	.960	31	1.725
7	.991	32	1.756
8	1.022	33	1.786
9	1.052	34	1,817
10	1.083	35	1.847
11	1.113	36	1.878
12	1.144	37	1.909
13	1.175	38	1.939
14	1.205	39	1.970
15	1,236	40	2.000
16	1.266	41	2.031
17	1.297	42	2,062
18	1.328	43	2.092
19	1.358	44	2.123
20	1.389	45	2.153
21	1.419	46	2.184
22	1.450	47	2.215
23	1.481	48	2.245
24	1.511	49	2.276
25	1.542	50	2.306

* Defined as 10,000 hp.-hrs.

The Influence of Age on Repair Costs

A table presents the results of a comprehensive study of road steam locomotive repair costs to indicate the effect of age.

The Question of First Cost

While it is true that an improved market and increased costs have exerted their influence upon steam locomotive purchase prices, a major effect has been refinement in design such as the utilization of improved alloys of greater strength, roller bearings, etc. The marked difference in original cost favoring steam over Diesel is an advantage which steam locomotive builders wish to maintain as wide as practicable, hence the tendency is to keep steam locomotive costs at a minimum.

There was no intention to imply that the switching locomotive evaluated was of the 4-8-8-4 wheel arrangement since even in America locomotives of this size are not assigned to switching services. The 4-8-8-4 locomotive referred to as costing $35.00 per hp. is a mainline freight and passenger locomotive designed for heavy, fast operation, while the switching locomotive is rated at 1,400 hp., with wheel arrangement unspecified. Utilization of the same unit price per horsepower when calculating switching locomotive and road power prices is questioned on the grounds that, since the switching locomotive is of a more simple design, its unit cost should be less. The error involved is in the opposite direction in that switching power weighs considerably more per horsepower and is therefore more expensive on this ba-

sis. On a weight basis, a survey of representative locomotive costs by the Railroad Division, American Society of Mechanical Engineers, developed the following for locomotive types treated in the paper: 4-8-4 steam road locomotive, 37 cents per lb.; 0-8-0 steam switching locomotive, 30 cents per lb.; 660-hp. Diesel-electric switchers, 31 cents per lb. These are based on weight of locomotive only, in working order.

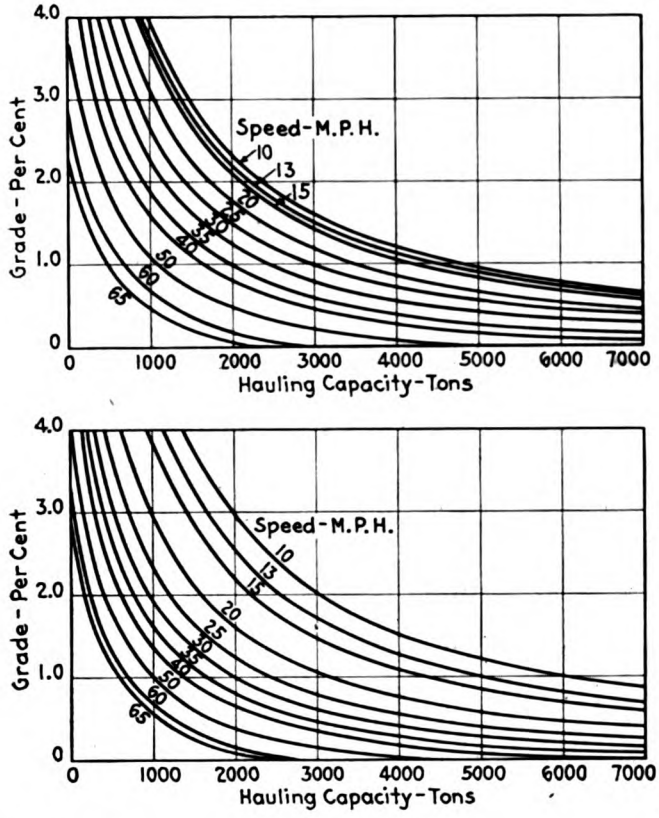


Fig. 11—Hauling capacity curves for trains of 40-ton cars—The upper chart is a group of curves, at various speeds, for a 4-8-8-4 type simple Mallet locomotive of 137,000 lb. tractive force and 540,000 lb. weight on drivers—The lower chart shows a similar group of curves for a 5,400-hp. Diesel-electric freight locomotive weighing 920,000 lb. on drivers and having a tractive force of 225,000 lb.

The weight of the 4-8-4, 5,000-nominal cylinder horsepower from which the curves of Fig. 4 are derived is 483,000 lb. Applying the 37 cents per pound unit cost, a total cost for this locomotive of $178,710 is obtained, or $35.74 per horsepower. Inasmuch as unit pound cost is available for only the 660-hp. Diesel, that price is used in the table. It will be noted that in one instance the horsepower basis produces the higher cost, in another that utilization of the weight basis results in the higher cost, while in the third there is, for practical purposes, no difference. In each case, the horsepower basis is the more conservative.

Actual costs of Diesel switching locomotives purchased during 1941 are shown in another table. It will be noted that 60 per cent of the total are more expensive than the $87.50 unit cost used in the comparison of capital charges and that only the 1,000-horsepower design is less costly.

Actual First Costs of Diesel Locomotives Per Unit of Power Output

Hp.	No. of loco.	Cost per horsepower		
		Max.	Min.	Average
360	10	$101.50	$100.80	$101.00
380	18	96.60	89.50	93.50
400	7	109.00	109.00	109.00
600	12	102.50	100.50	101.30
660	19	91.60	91.00	91,10
1,000	44	84.60	78.50	79.00
	110	$109.00	$78.50	$89.80

Unit First Costs of Locomotives Shown in Fig. 5

	Hp. or weight	Unit cost	Total cost
Diesels			
A	1,200	$87.50	$105,000
	340,000	0.31	105,400
B	900	87.50	78,750
	233,500	0.31	72,385
C	600	87.50	52,500
	216,000	0.31	66,960
0-8-0 Locomotives			
N	2,100	$35.00	$73,500
	248,000	0.30	74,400
O	1,500	35.00	52,500
	220,000	0.30	66,000

Why The Electric Locomotive Was Not Discussed

The dismissal of the electric locomotive with but slight reference was occasioned by the purpose of the paper, to evaluate the comparative characteristics of steam and Diesel-electric power. The steam-electric controversy has been so thoroughly covered by many writers that it was not injected in this study. The only reason that electric traction was referred to at all was to demonstrate that the line of demarcation between steam and electric power is more clearly marked than between the steam locomotive and its Diesel-powered competitor. Neither was density of traffic ignored as a justification for electrification since examples were cited where traffic considerations prompted the installation of electrified serv-

(*Continued on page 212*)

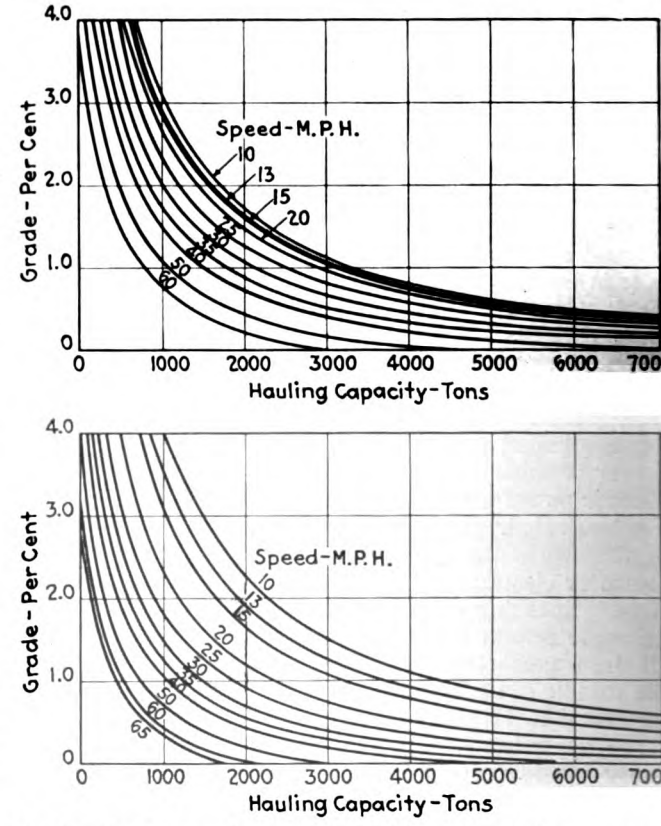


Fig. 12—Hauling capacity curves for freight trains of 40-ton cars at various speeds—The upper chart is for a 2-10-4 type steam freight locomotive having a tractive force of 93,000 lb. and a weight on drivers of 371,990 lb.; the lower chart is for a 4,050-hp. Diesel-electric freight locomotive having a tractive force of 168,750 lb. and weighing 690,000 lb. on drivers

B. & O. Simplifies Diners

Change reduces maintenance, increases capacity and prepares for future improvements

FACED with the need of redecorating and reconditioning its twenty Colonial diners, the Baltimore & Ohio decided to simplify the interior design and dispense with furniture and fittings for which replacements are now not available or very difficult to obtain. The ingenuity of the designers has produced a beautiful interior which has the advantage of low cost and less maintenance.

The cars, which were built in 1926, were fitted with hand-carved chairs of Colonial pattern. These have been replaced with chairs of relatively simple design, costing less than one-third of those they replaced. Originally the windows had multiple interior panes with arched mirrors above and leaded glass in the inner sash. These have been replaced with plain double windows. Elaborate egg and dart moulding has been replaced with plain and other decorations have been similarly simplified.

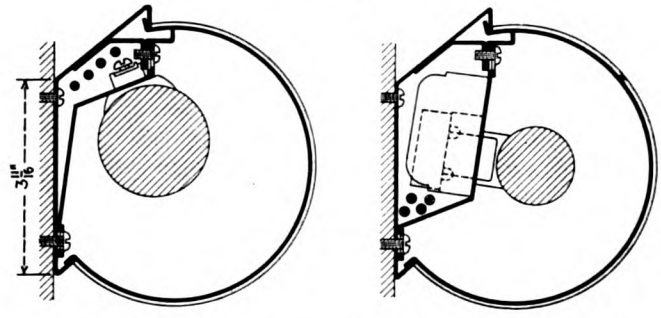
The cars have been painted, inside and out, new drapes hung at the windows, the floor recarpeted, new chairs and tables installed and new lighting fixtures added. The seating capacity has been increased. The diners formerly had four-seat tables at one side and two-seat tables on the other, making a total of 36 seats. Four-seat tables are now used on both sides, seating a total of 48.

The interior has been repainted with Dulux. The ceilings are oyster white, the upper side walls and panels are buff with beige trim, the lower side walls are tan and the mouldings of the panels between and above windows are oyster white. The bulkheads and buffet panels are blue with oyster white moulding.

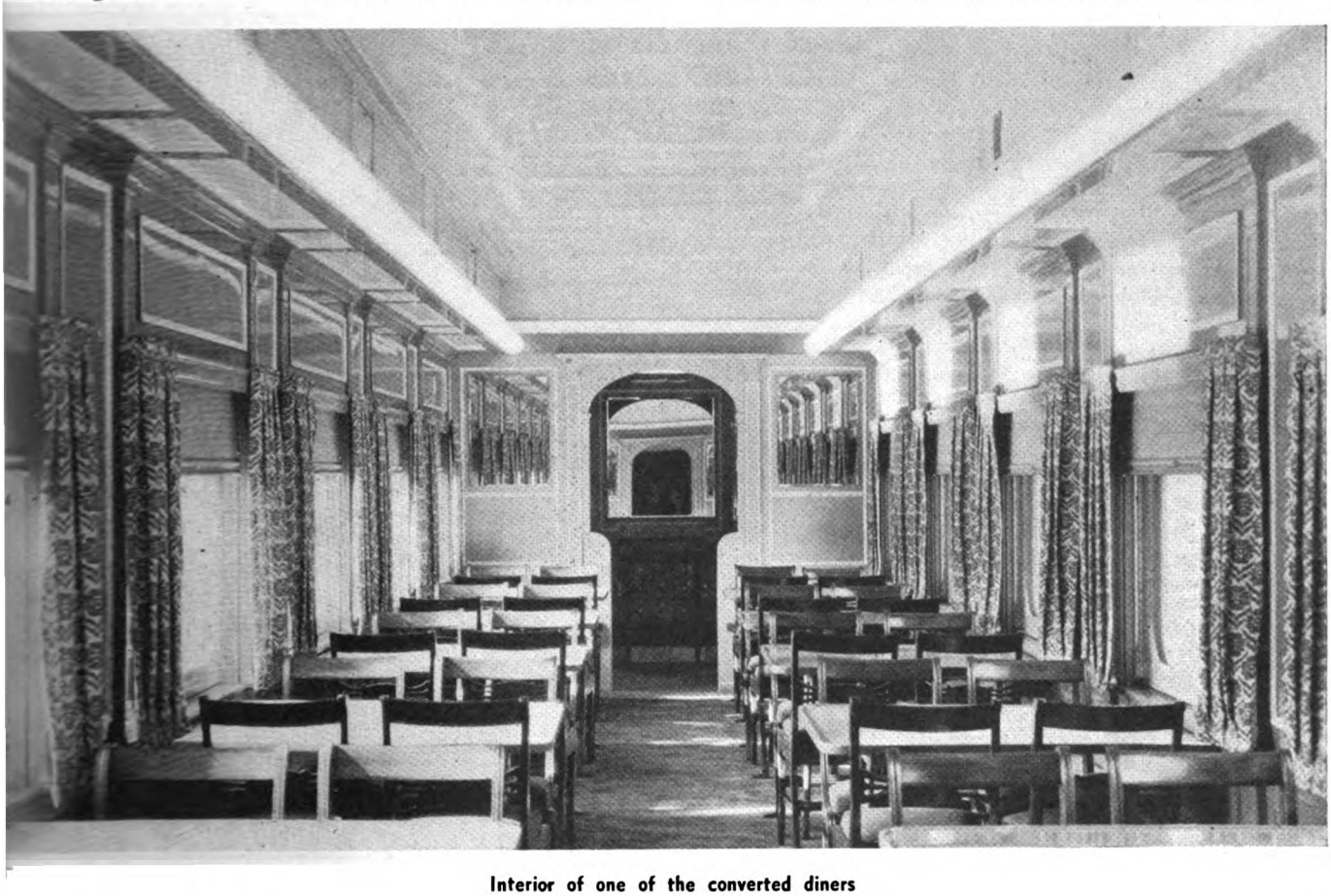
The pantasote shades are a peach color on the inside, while the drapes have a blue flower pattern with white linen back. The chair coverings are Normandy blue Grospoint. The Bigelow Sanford Consort grade carpets are figured and mulberry in tone.

The lighting fixtures in the dining section have been changed to two continuous lighting units at the sides of the deck sills. These replace the Colonial design center

(*Continued on page 212*)



A sectional view of one of the lighting fixtures showing how the reflector may be used for either incandescent or fluorescent lamps



Interior of one of the converted diners

Riding Quality Improved by

Snubbers on Freight-Car Trucks*

By Goodrich A. Lewis†

Higher-speed operation without danger to car or track—Car lading protected—Proper understanding of function needed —A. A. R. 1940 report questioned

SNUBBERS are now generally recognized as a very necessary part of the anatomy of the modern freight car. How they improve riding quality is a comparatively simple proposition in practical mechanics. The improvement effected by snubbers is almost unbelievable until, in connection with service tests, personal comparison is made of the riding quality of a pair of freight cars of identical design and load, one equipped with coil springs and the other having one coil in each of the four nests replaced by a snubber. Trying to sit on top of an unsnubbed 50-ton load of coal at a speed of about 50 m. p. h. was an unforgettable experience afforded in 1933, when one of the railroads found that a new venture in overnight fast freight operation was collapsing the arch bar trucks of these particular coal cars, and the occasional truck failures were causing expensive derailments. These coal cars had never given any particular trouble with operation at ordinary speed but in this special service everything went wrong with the trucks. The rock-ballasted, heavy-rail track was of the very best and entirely suited for high speed traffic, so the management blamed deficient maintenance and inspection for the trouble. The best efforts of the car department effected no improvement and the cars bounced just as badly as ever. Stronger cast steel trucks seemed out of the question for such old coal cars and experimentation with snubbers was suggested.

What the instruments showed about the relative riding quality of two adjacently coupled freight cars was in line with the fact that the observers found no discomfort riding on the wooden bench of the car equipped with snubbers, while in the car with the full complement of 16 double coil springs of the A. A. R. 1915 design the ride was most uncomfortable. The observers noted that the unsnubbed car bounced very badly during 96 min. of the 219-min. test trip, and with such violence that one could hear, above the noise of operation, the repeated pounding of the weight of the loaded car on the solid springs. This trouble was never present on the adjacent car where one double coil of each nest had been replaced by a snubber.

The excessive amount of bouncing was definitely associated with the fact that so much of the speed was above 45 m. p. h. and near the critical speed which was conducive to harmonic amplification of the vertical movement on the springs. This meant that, regardless of the fine condition of the track, there was a slight vertical impulse at every rail joint, and the recurrence of these very gentle impulses got in step with the natural vibration frequency of the coil springs, amplifying the oscillation and sustaining it at such a high level of violent bounce that only by the springs going solid was it interrupted.

Frequency of Oscillation

Natural frequency is the rate at which the freight car body oscillates vertically on its springs. Vertical disturbance means oscillation at some definite number of reciprocations per second. The frequency depends upon the superimposed weight. Doubling the weight lowers the frequency. It is also lowered by reducing the stiffness of the springs.

Freight-car springs produce a car bounce frequency in the general range between five and three oscillations per second decreasing from higher frequency to lower as the compression on the springs is increased by the weight increase from empty to capacity load. Freight-car frequencies are relatively higher than those of passenger cars where, due to the slight difference between empty and loaded weight, the resistance per inch of spring deflection can be much lower and the action softer.

The A. A. R. report of 1940, describing performance of high-speed freight trucks, contains the following fundamental statements regarding riding quality:

1—Soft springs are one of the requirements.

2—There must be a certain amount of absorption in the spring system to dampen the motion quickly.

3—Spring systems must be lively and capable of making the wheels follow the rails with as little variation as possible in wheel pressure on the rail.

Anyone who has studied the wheel action of a rapidly moving modern automobile or railroad passenger car can subscribe to these statements. The fine vertical riding quality and almost total freedom from shock result because the body remains substantially quiescent with reference to any local road or track roughness. This is made possible because the spring and snubbing systems are very sensitive and active. The best ride condition results from the use of springs with the softest possible action. Ideal softness presumes the lowest possible ultimate spring resistance consistent with the heaviest load to be carried, which should cause a reasonably high percentage of total deflection. Snubbers of soft action and quick reciprocating ability are vital to good riding quality because they immediately absorb any harmonic tendency in the spring system to develop amplified movement. Unsnubbed body bounce above the springs competes with the movement necessary below the springs to accommodate an uneven rail condition. This causes unnecessary shock and tends to make the springs go solid under conditions of full load.

Tank Car Test

A number of years ago, one of the tank car companies determined that the presence of snubbers on one of a pair of tank cars of identical construction permitted the

* Presented before a meeting of the Eastern Car Foremen's Association at New York City on March 12, 1943.

† Chief engineer, W. H. Miner, Inc., Chicago

car weight to compress the springs about 3/16 in. more under full load than on the other car with normal springing. Although it was mechanically obvious that this provision of greater compression would improve riding quality under any load condition, the question came up as to whether the reduced travel and spring capacity below the riding height would impair efficiency because of oversolid springs. A typical 1,000-mile trip for this pair of loaded cars, which involved all varieties of speed and track, showed that the car with the snubbers prevented bounce amplification and consequently no instance of a deflection closer than 1/4 in. from solid developed during the entire trip, but the adjacently coupled car with no snubbers went solid on the springs repeatedly.

It is evident that proper snubbing actually permits softer springing. This has been conclusively demonstrated in many other independent experiments in freight and passenger car operation at high speed. Freight car springs, of course, cannot be as soft as passenger car springs because of the very much wider variation between empty and loaded weight on the rail, and the necessity to maintain coupler heights above the rail between the narrow limits of 34½ in. maximum and 31½ in. minimum. Reduction in spring capacity, however, accompanied by adequate, soft and quick-acting snubbing during hundreds of miles of testing, invariably shows reduced maximum deflection below normal riding height and vastly better riding quality than before the correction was made.

A. A. R. Tests

About 12 years ago a large number of 50-ton cars were provided with trucks accommodating six coils per nest instead of four. This was intended to provide the extra capacity necessary to stop springs from going solid because of bouncing at speeds greater than 45 m. p. h. One of the functions of the A. A. R. 1936 or D-2 four-coil nest was to provide 25 per cent more capacity to this same end. Protecting springs from breakage by either method is poor economy because the intensity and frequency of vertical shock is enormously increased and the car structure and lading are punished with much more severity. This was fully demonstrated in the A. A. R. snubber tests of 1933. The fine purpose of the 1936 spring design, however, is its use in the proper combination with commercial snubbers to insure not only freedom from solid springs but the inherently finer riding quality of the original 1915 springs. A good criterion for maximum stiffness for any freight car is to make the ratio of the maximum load to be carried to the ultimate dynamic resistance of the corrected nests at least 61 per cent. This criterion is based on the 50-ton car as it is carried by 16 new double coil springs of 1915 design. The sprung load is 157,000 lb., equal to the maximum weight on the rail of 169,000 lb. minus the weight below the springs of about 12,000 lb. The ultimate resistance of the 16 double coil springs is about 256,000 lb. The ratio of 157,000 to 256,000 is about 61 per cent. Such loading compresses the nest about 1 in. of the total deflection of 1.69 in. Full load is carried below half travel, not above it, as is the case with the present A. A. R. D-2 or 1936 nests.

Snubber Function

The function of the snubber is merely to absorb enough energy per deflection to prevent bounce amplification. As a result, the demand on maximum deflection and total amount of spring movement is enormously reduced. The life and efficiency of the springs are correspondingly improved and it becomes possible to carry the loaded car properly with existing old springs with a great reduction in the number and intensity of vertical shocks which damage car structure and lading. Stabilization permits safe springing of the loaded car with a greater degree of compression, so that the empty or partially loaded car can get more compression, which means less stiffness, more of a floating ride, and improved riding quality.

The bouncing car on good track can be subjected to very severe vertical shock by any interruption of the bounce caused by some track irregularity which would be inconsequential if the car were quiet vertically. Repeated tests on good track have shown that shock sufficient to kick loads from the floor of the car are generated in alarming numbers whenever the unsnubbed car operates at its critical speed. Such shocks mean that the load on the brasses is varying between nothing at all and more than 200 per cent of normal, a very bad condition which is probably related to hot-box trouble.

Snubbers Protect Car and Lading

Tests have shown that the stiffer the car construction and the more noncompressible or immovable the load the more violent is the amplitude of bounce and consequently the greater the number and intensity of the vertical shocks. This is the reason why, under the stress of recent operation, the tank car has proved to be more in need of the stabilization provided by snubbers than any other type of car. The apparent reason for this is that the load of a tank car is noncompressible and its construction is rigid, and consequently there is maximum bounce amplification and shock count as compared with equipment such as box and open-top cars. In such framed structure equipment there is apparently some reduction of bounce amplitude due to the work being done on the car framework and the bouncing load. This explains the recently noted tendency for the bouncing tank car to develop enough vertical shock to unlock couplers while other cars of identical weight, but with less rigid construction and solidity of load, do not do so.

The reduction of spring movement and shock count by snubbing provides definite improvement in the maintenance of many parts of the car besides the springs. Some tank car owners who have had considerable experience with maintenance costs for cars with and without snubbers know that snubbers are worthwhile even though bounce shock has no harmful effect upon fluid loads. There is much evidence that freight claims on commodities subject to breakage by repetition of vertical shock caused by upward acceleration of the car floor, such as for example sewer pipe, furniture, fresh fruits and vegetables, etc., have been reduced by the use of snubbers. Cement hopper cars equipped with snubbers are said to prevent the packing of this product which obviously results from a bouncing car. It was recently reported that the use of snubbers is preventing the displacement and damage of machined projectiles as well as the breakage of floor boards in very high-speed freight service. These results point conclusively to a corresponding reduction of stress and fatigue on parts of the car structure, reduction in the number of waste grabs, etc., which guarantee further profitable investment for reduced cost of maintenance as well as increased operating safety.

Error in A. A. R. 1940 Report

The Association of American Railroads' report, dated April, 1940, entitled "Tests of Trucks for High-Speed Freight Service," is important because it vitally concerns the mechanics and economics of freight train operation.

It again emphasizes, as did the A. A. R. snubber report of 1934, that the standard A. A. R. truck with high capacity standard springs and no specified means for stabilization has very unsatisfactory performance at speeds above 40 miles per hour. The 1940 report is particularly valuable because it proves that standard A. A. R. 50-ton trucks without snubbers and sprung with the latest high capacity 1936 springs developed a dangerously bad riding quality at speeds of from 60 to 85 m. p. h. This report, however, made certain statements which lend the impression that most of the A. A. R. trucks now in service cannot be adjusted to perform safely at very high speed. It is true that the standard A. A. R. truck equipped with four A. A. R. 1936 double coils per nest performed very badly and this, of course, served to exaggerate the good performance of the special softly sprung trucks. But the tests did not include an A. A. R. truck improved by exactly the same mechanics of snubbing and softer springing which the report gives as the reason for the good performance of the special trucks. Inclusion of properly improved A. A. R. trucks in these tests unquestionably would have demonstrated thoroughly stabilized operation at very high speed and prevented the erroneous statement in the 1940 report that snubbers known to give good service at speeds below 60 miles per hour are of little, if any, value at higher speeds. Independent tests, as well as the data of the 1940 report, refute this statement.

One of the trucks in this A. A. R. test had standard A. A. R. construction and included snubbers in the spring systems. Of course, the riding quality was bad because the truck was so unnecessarily oversprung. But such as it was, this riding quality was a tremendous improvement at all speeds above 60 m. p. h. over that of the A. A. R. car having the same spring capacity and no snubbing. Had the spring capacity been reduced from only 49 per cent compression to at least 61 per cent great ride improvement would have occurred and the truck would very probably have been declared to be safe at high speed instead of rejected as unsafe.

The unprecedented train speeds since 1940 have rather definitely proved that the billion-dollar investment in conventional cast steel trucks is fundamentally sound, and that the procedure needed to anticipate the high speed era to come is the program of snubbing now well under way.

B. & O. Simplifies Diners

(*Continued from page 209*)

ceiling and wall bracket fixtures; the cost of reconditioning the old units being sufficient to warrant the new.

The light source in the new fixtures consists of 15-watt lamps, 54 on each side, on $8\frac{5}{16}$-in. centers. Each row is housed in a cylindrical fixture which consists of mounting plates and plastic diffusers made in sections to form a continuous unit. The plastic diffusing sections snap into flanges at the edge of the mounting plates and require no screw fastenings.

The continuous reflector, also made in sections, is an ingenious device. Placed as shown in the left-hand drawing, it is now used to mount the incandescent lamps in angle sockets. When turned over, as shown in the right-hand drawing, the reflector is properly placed for the mounting of 40-watt, 48-in. fluorescent lamps and a space is provided behind the reflector for the fluorescent-lamp auxiliaries. Both sides of the reflector are coated with white heat-resisting enamel and they are punched and tapped for mounting of both incandescent and fluorescent sockets and auxiliaries. The lighting units are mounted so that the lower edges are slightly below the decks to avoid leaving the decks in shadow.

Lighting units in the passageway and over the buffet are also designed so that the present incandescent lamps may be replaced with fluorescent. The lighting equipment was supplied by the Safety Car Heating and Lighting Company.

No changes have been made in trucks, superstructure or the standard Baltimore & Ohio air conditioning with which the cars are equipped.

The work of reconditioning was done in the railroad's shops in Baltimore, Md., under the direction of W. B. Whitsitt, chief engineer, motive power and equipment.

Diesel or Steam Power?

(*Continued from page 208*)

ices. In the United States, where extended distances through sparsely populated territory are common, traffic density will in but few territories economically support the heavy carrying charges incident to electrification. At this point it may be well to emphasize that the author appreciates that many features exhibited by the different power types will not appeal to the engineers of Great Britain as they do in the United States, a striking example being the utilization of oil fuel, especially in the western section of the United States.

Upon What Shall Depreciation Be Based?

The cost data presented are those submitted by the various railways and, for that reason, interest charges are not included, nor depreciation in most instances inasmuch as costs are mainly direct charges to operations. Interest, of course, is dependent upon the amount invested and the money rate which can be obtained. In all but one instance comparative first costs of road power are shown to which may be applied interest rates prevailing at any time or in any country. Depreciation is ever becoming a more controversial issue and a highly questionable one. Shall depreciation be based upon miles, upon years, or a combination of the two? Surely if depreciation is the wearing out of serviceable units—say locomotive miles—utilization will govern depreciation rates, not years—and there is always the spectre of obsolescence. Especially so if Diesel competion forces radical departure from steam locomotive design or if post-war air competition affects the adequacy of both. Calculations based upon mileages operated in 10 months and the mileage depreciation charges for the period, shown in Table V*, indicate that the following approximate service lives are expected: Freight Diesel, 20 years; freight steam, 28 years; passenger Diesel, 12 years; passenger steam, 28 years. Hence 15 years cannot be assumed in all instances.

[An appendix to this closure contained a series of 46 steam-Diesel-electric curves showing (1) speed-time on various grades; (2) speed-distance on various grades; (3) drawbar horsepower-speed; (4) drawbar pull-speed and (5) tonnage capacity at selected speeds on various grades. Figs. 6 to 12, inclusive, accompanying this article are selected from this group of curves.]

* See page 33 of the January, 1943, *Railway Mechanical Engineer*.

Harry Miller Pflager

Franklin Institute awards the Henderson Medal for achievements in the development of steel castings

HARRY MILLER PFLAGER, senior vice-president of the General Steel Castings Corporation, was awarded the George R. Henderson Medal by the Franklin Institute, at a dinner in Philadelphia on April 21. This medal was established to recognize meritorious inventions or discoveries in the field of railway engineering. The citation for Mr. Pflager indicated that it was for the development of the cast steel one-piece bed for steam locomotives, an outstanding improvement in the modernization of the locomotive. It is typical, however, of many other innovations devised by Mr. Pflager in the evolution of the steel castings industry, and particularly in the art of making large and intricate one-piece castings for railroad equipment. Among his other patents of this type may be mentioned those for four-wheel and six-wheel passenger car trucks, with the truck frames cast in one piece; also making the bottom of the locomotive tender tank an integral part of the cast steel tender frame.



Harry Miller Pflager

Mr. Pflager was born in St. Louis, Mo., November 29, 1866. He attended the public schools in St. Louis and the Manual Training School of that city, which is said to be the first one established in this country. While attending the Manual Training School and, later, while a student in mechanical engineering at Washington University, he worked for the Pullman Company during vacations and week-ends. He was persuaded to take a permanent position with the Pullman Company in Chicago, before completing his university course.

He remained with the Pullman Company until 1901, advancing from draftsman to mechanical inspector at Chicago, assistant superintendent of the shops at St. Louis, chief inspector of the Pullman Company, and mechanical superintendent. He was vice-president and general manager of the American Clock Company from 1901 to 1903 and became assistant vice-president of the American Steel Foundries in 1903. The following year he became associated with Clarence H. Howard, as senior vice-president, in the founding of the Commonwealth Steel Company. He continued in that capacity with the Commonwealth Steel Company and its successor, the General Steel Castings Corporation. Although in his seventy-seventh year, he is still active and has recently devoted his energies to assisting in the development of the cast armor one-piece top hulls for combat tanks, which have been perfected by the engineers of the General Steel Castings Corporation.

Mr. Pflager has visited Europe many times and after the first World War became much interested in the European railways; many European trains were equipped with Commonwealth one-piece trucks and platform castings. He has also visited South America and Africa, and he made a trip around the world in 1931.

He has always taken a keen interest in the welfare and progress of young men, not alone in his own organization, but in the community at large. He has served many terms as a member of the board of directors of the Metropolitan Y. M. C. A. of St. Louis and was at one time its president. He has also been active in the promotion of the Granite City Y. M. C. A., which is located not far from the Commonwealth plant. He is a trustee of Iberia College, Iberia, Mo., an institution established for the farm boys of the Ozark Mountain districts. He is also a trustee of Drury College of Springfield, Mo., which is conducted under the auspices of the Congregational Church.

Psychologists and students of human nature have found that in some instances a man may be equally well fitted for a career as an engineer, or as a scientific farmer. Mr. Pflager has a farm at Sulphur Springs, Mo., on the banks of the Mississippi river, about thirty miles south of St. Louis. It is reported that his principal interest in the farm is that it gives him a new field in which to exercise his inventive mind in developing new ideas of farming.

Speeding Up Operations

Careful Planning Necessary

The facilities and layout of engine terminals in general practice have been well established for given conditions. It is difficult to propose something new from this standpoint that would reduce the time of locomotives at engine terminals, since it is assumed that consideration has already been given to the development of the terminal in keeping with the business to be handled, and in this manner having established a satisfactory handling time at a given location.

Under present-day conditions, however, with the loss of male employees, the handling time of the power tends to increase. It is imperative, therefore, that ways and means be found to keep this time under control and reduce it, if possible. The following points are suggested:

1.—Anticipate time power will be ready for service, to the end that time in engine terminal will be reduced to a minimum.

2.—Keep a careful check at each terminal to determine any increases in the handling time; study the causes for such increases and take corrective action.

3.—Determine by a check of the Selective Service classification and the normal turnover the positions that will become vacant, and in anticipation of such vacancies inaugurate a program of instruction and training to have available the most competent employees possible.

4.—Labor saving devices and practices must be studied and their use extended.

5.—Bottlenecks can quickly form at engine terminals, particularly at points where locomotive inspection, fire cleaning, washing, coaling and sanding and taking of water are all performed on the inbound tracks. In many instances separation of these functions will reduce handling time.

6.—Install coal and ash handling facilities at strategic points for the handling of yard shifting power, so as to keep the main engine terminal operation free for the handling of road power.—*H. W. Jones, Chief of Motive Power, Pennsylvania Railroad.*

Co-operation Essential

In order to get maximum utilization from locomotives, it is necessary that the mechanical and operating department officers co-operate in a program of supervising the use that is made of the power, and the necessary maintenance attention.

All of the power possible should be operated on extended locomotive run programs of more than one engine crew district. Switch locomotives should be assigned, so far as possible, to operate three consecutive shifts, and also to operate so far as possible two consecutive shifts without being turned into the roundhouse.

Each locomotive should be assigned to a maintenance terminal and one master mechanic should be responsible for running maintenance.

Any surplus power should be at the maintenance terminal in order that repairs can be made while the locomotive is laying over. Study should be made to reduce out-of-service days for running repairs, so as to arrange roundhouse forces on the first, second and third shifts, to the end that locomotives can be turned as quickly during the second and third shifts as they are on the first shift. Work on locomotives out of service for heavy running repairs should be carried along to the maximum extent on the second and third shifts.

Out of service days for classified repairs should be reduced to a minimum, which necessitates working as many men as possible on each locomotive during the time it is out of service. In general repair shops a second shift assignment has been found to materially reduce out of service days for these locomotives.

It is imperative that necessary materials be available to make repairs to the locomotives as they become due for shop, which necessitates anticipating the needed material more in advance of the shopping of the locomotive than has been done formerly. This is due to more time being required to get delivery on material at this time than has been true in the past.—*J. M. Nicholson, Asst. to V. P., A. T. & S. F.*

Several Practical Suggestions

After the arrival of the locomotive at the engine terminal and when inspection has been completed, it can be determined how long it will take to get the engine ready. This will indicate the engines requiring the lightest repairs and they can be given preference over those requiring heavy repairs. In some instances it will not be necessary to put the locomotives in the enginehouse.

At the majority of large terminals there are peak loads and during these periods the inspection forces should be increased to prevent delays in handling. This is also true of the coal dock and ashpit forces, as well as other handling forces.

The time freight engines are held in the terminals for repairs can be reduced by giving preference to freight power requiring the lightest repairs. In the majority of cases this will be the most modern power with the greatest tractive effort. Anticipation of material needed to make repairs, and having it available at the time needed will also help to prevent delays to engines waiting for material to be manufactured or machined. Engines in the shop for form work should be worked on continuously during the 24-hour period to reduce the elapsed time required to perform this work, and should be located, if possible, nearest to the machine shop to facilitate the handling of material required for repairs.

The mechanical department in O.K.'ing power to the transportation department, should report the engine ready for service in sufficient time so that the crew will be available at the same time the engine is ready, or as nearly thereto as possible, so as to prevent any loss of time by the crew waiting for the engine.—*L. L. Robinson, Acting Gen. Supt. of Locomotive Maint., Baltimore & Ohio.*

Proper Balance Must Be Maintained

The ability of motive power to perform its intended function is vitally affected by two somewhat diametrically opposed factors, each of which has no particular bearing on the physical ability of the locomotive to do so.

The first of these factors is the time which each unit is available for the actual movement of cars, and the second is the fitness of the unit to function without delay or failure during that time. The first of these factors fathers the desirability of movement through engine terminals in a minimum time. The second factor fathers the desirability of retaining each unit in the engine terminal long enough to insure the proper performance of all necessary inspection and repair work. Experience has shown that too much emphasis on the first factor invariably produces a detrimental neglect of the second. There is, therefore, a definite need to maintain the proper balance between the two.

The maintaining of this balance is a matter meriting careful study. The first element of the study should involve the determination of what actually is the minimum average time required to consummate the necessary inspection and repair work in order to insure that when the locomotive is dispatched it will be in condition to do its required job without failure or delay.

This determination must of necessity, incorporate a consideration of the type of locomotive, the service in which it is used, federal and company requirements, availability and type of manpower; adequacy of tools, machinery and housing facilities; and the pursuance of efficient mechanical methods. By studying the maintenance and inspection requirements of a representative group of locomotives over an extended period, augmenting past experience and performance with time studies, if necessary, a minimum average efficient time requirement for repairs and inspection can be developed. The application of this yardstick to any selected terminal will satisfactorily reflect information as to what would constitute a proper time for inspec-

in Engine Terminals

tion and repairs at that particular terminal. After any changes in facilities, tools, machinery and methods found desirable have been made, this time figure, which might be called the "mechanical requirements time," can then be established.

It may then be found that the "servicing time" or that which is used between the point of arrival and time over the turntable inbound, plus the time over the turntable outbound to that of actual departure from engine terminal is too high. This fact will necessitate a second study of track layout, coaling, sanding and ash pit facilities. Here again properly conducted investigations of results obtained at the terminal under investigation, as well as at terminals known to be equipped with proper facilities and track arrangements, will point out what may be saved in locomotive hours by rearrangement of track and installation of proper efficient facilities. After all improvements which can be made in this respect are consummated, an average efficient so-called "servicing time" for the terminal can be established. The sum of the "mechanical" and "servicing" times thus established will then represent an average maximum "turning time" to which the terminal should be held.

If the studies proposed are conscientiously and accurately made, pressure on the local engine terminal management to meet the time set will produce good results without creating a tendency to slight important inspection and repair operations, which induces failures and delays enroute. Blind, unstudied demands for the reduction of turning time without regard for maintenance and inspection requirements may well drive the local supervision to the neglect of important inspection and repair needs which, in turn, will make null and void all efforts to obtain a maximum production from each unit of motive power.—*F. K. Mitchell, Asst. Gen. S. M. P. and R. S., New York Central.*

S. P. Meets Contingency

With one of the heaviest war loads to carry of any railroad in the United States, and despite receipt of 133 new steam and 77 new Diesel locomotives from 1939 to and including March, 1943, the Southern Pacific early in 1942 realized that only by maximum utilization of power would it be possible to handle the business. Study was inaugurated to reduce the time locomotives are in the hands of mechanical department. Accomplishment was by:

1.—Immediately handling the locomotive on arrival at the receiving track, where outside inspection, cleaning and checking for federal inspection and boiler wash dates were made.

2.—Prompt movement into the house for pit inspection, repairs, lubrication and service work.

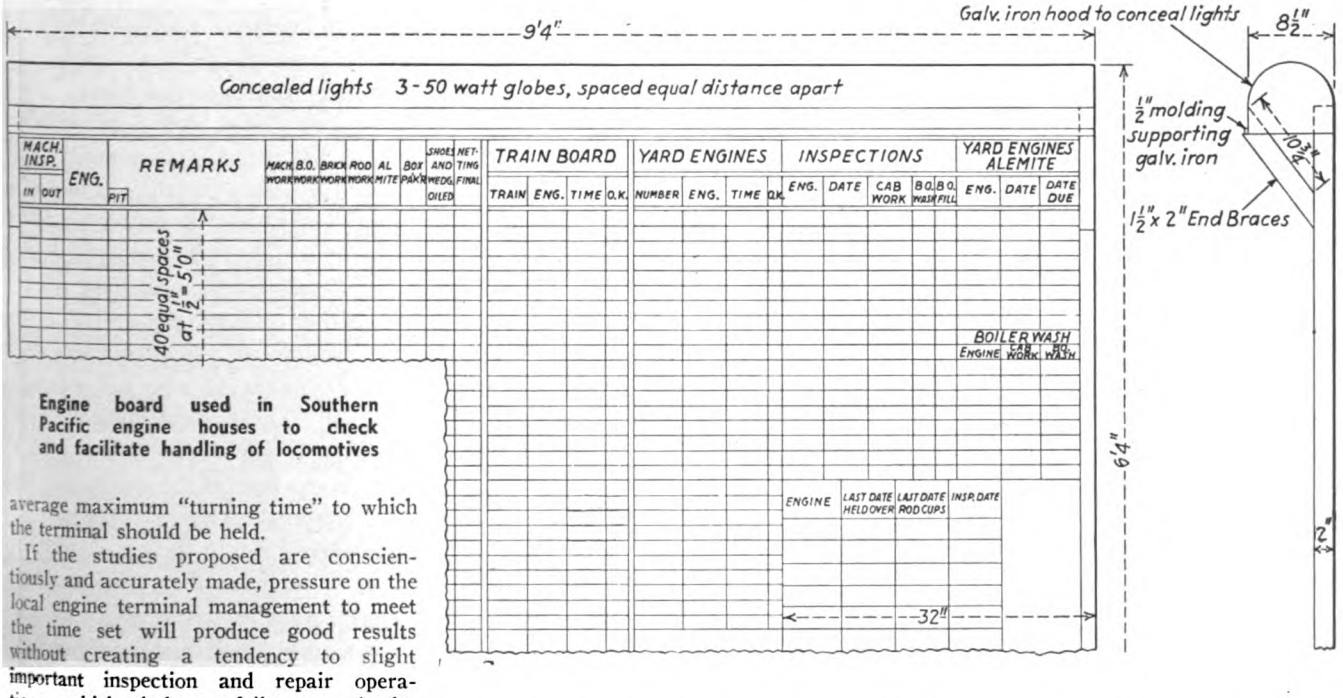
3.—Careful programming of federal inspection, boilerwash and heavy repairs, so that as nearly a minimum number of locomotives will be out of service at a time as possible; the principal repair work to be handled at monthly inspections. A conveniently located engine board is maintained, showing the engine, time called, and repairs OK'd, so that roundhouse forces can make the out-of-house times; it is shown in the illustration.

4.—Quick outbound movement from house in time to provide fuel, water, tools and supplies, to make called times.

5.—Arrangements were worked out with the operating department so that roundhouse foreman's clerk and chief dispatcher are the only two men handling power offered and called. The roundhouse clerk maintains a record of arrival time of locomotive on receiving track, time offered to dispatcher, and time called. Power is handled so that locomotives are offered sufficiently in advance of ready time to provide for a two-hour call; the enginehouse forces furnish the time to the dispatcher two hours in advance of time the engine is actually ready, so that crew is called for the time the engine will actually be released by the roundhouse for road service.

6.—Maintaining adequate forces of inspectors, hostlers, helpers, supplymen, ash pit men, and adequate supervision to insure that no time is lost in moving locomotives to and from the house. At large roundhouses, an assistant roundhouse foreman handles outside work; that is, turntable, hostling, outside inspection, fueling and placing calls. This decreases engine delays.

7.—Heavy traffic and larger power warranted many improvements, but the suddenness of the increase made it necessary that greatest use be made of existing facilities. Authority has been granted, and a great many installations have been made of additional properly-located water, fuel and sanding facilities; improved and additional track layouts have been provided to minimize congestion of inbound and outbound leads between yards and roundhouses. Longer turntables, additional and longer engine pits, have been provided, and machine tool and small tool equipment purchased.—*S. M. Houston, Asst. G. S. M. P., Southern Pacific.*



Engine board used in Southern Pacific engine houses to check and facilitate handling of locomotives

EDITORIALS

Tell Us How

A trouble maker as old as railroading itself still appears to be the primary cause of headaches for men in the car departments. In spite of all the attention which the hot box, or hot journal as some prefer to call it, has had from mechanical officers and lubricating experts, there are still too many occasions on which cars must be set out for attention or accidents occur because of hot boxes. As one car department head has recently stated, "One is one too many." *What has been done, what is being done, what can be done to eliminate all, or a major part, of the lost time, damage, unprofitable use of labor and general headaches caused by this perennial offender?* Is it design; is it the bearing; is it packing methods; is it inspection, or is it supervision that is at fault? This is a chance for you to tell your story or air your views. We want your comments for our roundtable in the June issue. Your letter must be in our New York office not later than May 14.

The Problem Of Absenteeism

A number of constructive suggestions for reducing absenteeism were developed as the result of the roundtable discussion in the April issue of the *Railway Mechanical Engineer*. The manpower situation on the railroads and in industry is such that no effort should be overlooked to utilize effectively every man-hour available. That the absenteeism problem is one of first importance is indicated by the fact that according to a survey made by the Management Research Division of the National Industrial Conference Board, the loss to American industry during 1942 was more than 422 million man-days, an increase of 72 million over 1941. This is exclusive of time lost because of industrial accidents and time spent on approved leaves of absence. Industrial and labor leaders throughout the country, as well as governmental authorities, have been showing greater and greater concern over this handicap to maximum production, and determined efforts are being made throughout the nation to reduce absenteeism to a minimum.

The National Industrial Conference Board, as the result of its studies, suggests that four "fundamental methods" of bringing moral pressure upon the employees to improve attendance have been found effective. They are:

1—*The use of key employees or of employee representatives to discipline absentees.* Joint labor-management committees serve this purpose admirably by making decisions on individual cases and by carrying the decisions of the committee back into the plant.

2—*Discipline undertaken entirely by management.* British and American industrial management have both found individual interviews helpful in reducing absenteeism. Returning absentees are summoned to the personnel office, or to some other department selected by the management, and questioned as to their reasons for absence. They are then told of the serious effect absenteeism has upon production. One company calls a meeting each day of all employees who are returning to work after an absence. These employees are gathered together in one large room, where the bad effects of absenteeism upon production are explained. The number of employees present serves to illustrate the extensiveness of employee absenteeism.

3—*Premiums for good attendance.* Attendance bonuses and awards were found in some instances to be effective means of combating absenteeism in peacetime. However, wages at the present time have reached so high a level that they, themselves, are partly responsible for absenteeism.

4—*Appeals to patriotism.* Not all employees look upon war production as a second battlefront, nor do all of them respond to interpretative statistics which show the number of ships, planes and guns which are not being built as the result of time lost through absenteeism. Poster campaigns have been tried and found ef-

fective in some plants, especially when the information they contain is directly related to the company for which they are working.

Light For Welding

Nearly all electric arc welding done in railroad shops is performed under medium or low levels of general illumination against a black or at least dark background. The primary reason for this is that dark colors prevail in railroad shops. An incidental and probably accidental advantage is that the dark surroundings reflect little ultraviolet light which might be harmful to other workers in the shop. A disadvantage is the enormously high contrasts of illumination under which the welder must see his work with and without the arc.

Recent tests made in war plant welding shops indicate the desirability of using high values of general illumination. As an empirical upper limit, with respect to comfort from other considerations, the illumination for a welding area was designed for 150 foot-candles obtained from 400-watt mercury-vapor lamps in R. L. M. domes. Reflecting surfaces such as walls and columns were painted with zinc oxide base paints which absorb ultraviolet light and reflect visible light. Workers in the welding area who were not welders were given safety goggles fitted with No. 4 lenses which protect their eyes from the arcs, since they are always at least three or four times as far from the arc as the welder. These lenses also permit good vision in the shop under the general lighting. The ultraviolet-absorbing, high reflection paints reduced anxiety about ultraviolet burns from reflected radiation.

The actual welding operations have been well served by the high general illumination. As each welding rod is consumed the welder raises his hood and easy contrast conditions impose no difficult readjustment for his eyes. Individual welders have also discovered that if a white asbestos mask is set at an angle on either side of a seam, it increases the clarity with which they can see the line they are welding.

It would be ridiculous to suggest 150 foot-candles of illumination for an erecting shop or to think of painting the shop and its contents with white zinc oxide paint, but it is not difficult to do these things in small areas. Where the light sources can be placed close to the work, 150 foot-candles offers no great difficulty and where the area is small, as it is in some places assigned to the welding of small parts, a coat of zinc oxide paint does not seem impracticable. This might also be applied to the inside of welding screens. The suggestion seems to have definite possibilities, even in the railroad shop, for improving quality and speed of welding and bettering the conditions under which the welder works.

Have You A Shop Library?

It was with great pleasure and no small amount of surprise that we discovered, on a recent visit to a railway production plant a shop library of technical magazines actually intended for the use of shop personnel. It is not uncommon to find adequate libraries in the offices of mechanical department officials but it is very rare—this being the only instance of which we know—to find carefully filed but easily accessible copies of the publications devoted to shop practices and methods, among them the *Railway Mechanical Engineer*.

This library was located in a bay just off the working floor of the machine shop, readily available for foremen, workmen and apprentices, all of whom were privileged to make use of any of the publications on file. The dog-eared condition of many of the magazines gave evidence that this privilege was being used extensively. Twelve back issues are kept in the file; older copies before being discarded are examined carefully and from them are clipped all items relating to shop practice, machine setup, jigs, fixtures, tool grinding, etc., which might prove of further reference value. These clippings are assembled in scrap books where they remain available as a source of information long past the time that the magazine itself might have been expected to prove useful.

The superintendent of this shop is proud of his "library" and feels that it has done much to encourage the mechanics and others in the shop in their attempt to keep up-to-date on modern methods. Discussion of this matter with some of the men proved to our satisfaction that this superintendent was justified in his pride.

When Are We Going To Get Cars?

Late in 1942 the railroads formulated a freight-car program calling for 80,000 new cars in 1943. This was presented to WPB by ODT and before the end of the year WPB announced authorizations for the first six months of 20,000 freight cars, implying that the railroads would get half of the cars they requested for the year. Before the end of February, 1943, releases had been granted by WPB for building practically the entire 20,000 cars.

But authorizations and releases by WPB have not been enough to get cars built. Failures to secure materials have held up the program. There now remain two months of the first half of the year and only a few hundred cars have been delivered. The program for the first six months will scarcely be completed before the end of the third quarter. What is being done toward the formulation of a program for the second half of the year?

The railroads are in great need of cars. Surplus cars (about 7,000 for gondola and hopper cars and 35,000 for all freight cars) are down to dangerous levels which indicate a degree of fluidity never before attained and one which has already exceeded the margin of safety in some cases. This situation is dangerous to the future conduct of the war.

Not all of the available car-building facilities in the country are now engaged. A cooperative attitude on the part of WPB would get such facilities into production on orders to be released in the program of the second half of the year with as little delay as possible. Indeed, if action toward that end were started now, there would probably be no deliveries until early in August, assuming no unusual delays in the procurement of the necessary materials. If the entire program for the second half is to await the completion of deliveries for the first half before it can start, at least two full months of needed production time will be lost. Some of this loss could be offset were WPB to adopt a reasonable degree of flexibility in dealing with releases and allocations to the car builders. Under present methods as programs are completed men must be laid off and facilities remain idle. The reorganization of forces after layoffs—always wasteful—under the present muddled manpower situation, is becoming next to impossible.

Might not less of WPB and more of ODT in the handling of the releases and allocations of transportation equipment to the transportation agencies that are to use it, and, indeed, to the builders who are to produce it, make better use of the materials and men available for the production of transportation equipment than is now being done? ODT is a claimant agency under the CMP plan and, as such, is as much a responsible government agency as WPB. Indeed, its responsibility for the maintenance of adequate transportation service makes it equally as important in the successful prosecution of the war as is WPB. With the critical materials once allocated under the CMP plan, why should it be necessary for WPB further to concern itself with the types of cars to be ordered and with the railroads to which they are to be released

Bureaucratic red tape is not an effective instrument for winning the war.

110 Volts For Passenger Cars

"Some 110-volt cars also come into the yard, but these do not require charging." This apparently unimportant statement appears in an article in the Electrical Section of this issue under the title "Charging Sets on Rails." The article describes passenger-car battery charging facilities used in the Jacksonville Terminal Company yard at Jacksonville, Fla., and the cars referred to are those of the Norfolk & Western which came into this yard. The 32- and 64-volt cars do require battery charging, but the 110-volt cars do not.

It should not be supposed from this that the use of 110-volt car lighting and air-conditioning systems would eliminate the need for yard charging, but it does serve to emphasize again the desirability of using 110 or, at least, 64 volts. Basically, the reasons for using 110 volts on cars are as follows:

The 110-volt incandescent lamps are everywhere available and at a lower cost than 32-volt lamps.

Contactors and control apparatus are much smaller than those required for 32 volts.

Wayside a. c. power (everywhere available) can be used for lighting parked cars.

Standard commercial 110-volt equipment, such as fan motors, portable radios, grilles, mixers, toasters, milk warmers, etc., can be used.

Less copper wire and smaller conduit can be used.

The design of larger capacity axle generators is made easier, and they can be made with increased capacity at lower cut-in speeds.

Cost and size of generators and motors can be reduced.

Cost of brush and commutator maintenance is decreased on both generator and compressor driving motors.

Cost of switchboard, fuses and circuit breakers is reduced since current values are less and there need be fewer circuits.

A large number of battery cells with a small number of plates in parallel will give better performance than fewer cells with a large number of plates in parallel.

Battery cells can be more easily disposed within the permissible space requirements.

Little can now be done to improve the existing situation, but it should be given consideration. The postwar car must have what it takes to compete with other forms of passenger traffic and 110-volt systems would help. Operators are going to say, "We have been doing it with 32 volts, why shouldn't we continue?" In reply to this the car-lighting and air-conditioning engineers can offer the above list of qualifications. Some will want to know what can be done about trainlining one car to the next one in case of a power system failure. This is not done now since on air-conditioned cars this usually means two failures instead of one. The electric power system on each car should be at least as independent as that of an automobile on the highway

The trend toward fluorescent lighting is another item favoring the higher voltage systems. No conversion apparatus is needed for fluorescent lighting with either 64- or 110-volt systems. In this way, full advantage can be taken of these high-efficiency lighting units and the cost of conversion equipment eliminated.

The cost of batteries might be increased somewhat and there would be more cells to flush, but this would be at least partly offset by improved performance and perhaps better life. Judging from the experience of the Jacksonville terminal, charging requirements would be reduced, indicating better system performance.

With the Car Foremen and Inspectors

Three Devices For the Car Shop

Three exceptionally ingenious devices designed to save labor and time in car repair work at the South Tacoma (Wash.) shops of the Northern Pacific are shown in the illustrations.

The first of these is a portable machine designed for close work under freight cars and used for reaming bolt



Portable air-operated reaming device for work in close quarters under freight cars

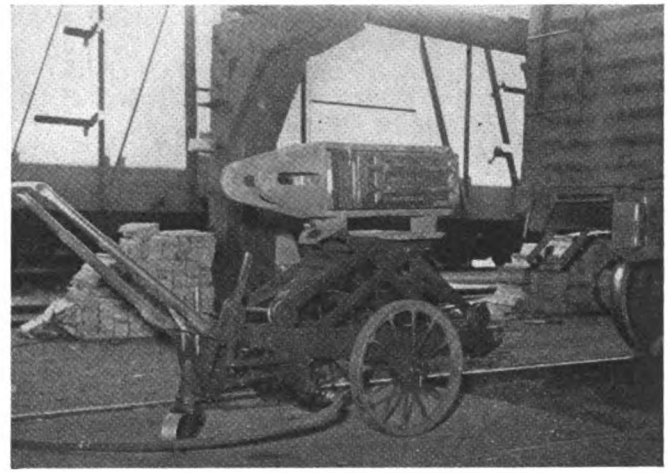
and rivet holes. The machine is mounted on a small compact three-wheel dolly, or truck. Just ahead of the operator's seat is a hinged steel frame which carries a horizontal bar with clevis at the outer end to support the air motor by means of two hinge pins. The rigid steel frame swings slightly in a vertical plane and the air motor is caused to move up or down by a small air cylinder (not shown in the illustration), this cylinder working against a small coil spring which returns the steel frame to its original position after each operation. The air cylinder and the air motor are both operated by suitable levers and extension rods, shown in the illustration, with air hose connections made as indicated.

The working range of this machine enables holes to be reamed either in the bottom flange of a center sill or as high as a side sill without necessitating the operator going under the car, or using blocking of any kind. As the reaming operation progresses, it is obvious that the horizontal arm gradually tips upward and the hinge connection of the air motor enables it to be kept in a vertical position by moving the machine slightly nearer the car until the hole is completely reamed.

The second device is a portable draft gear hoist, air-motor operated and used for removing and applying draft gears to freight cars. Referring to the illustration the general construction of the device will be apparent. It consists essentially of a rigid steel frame, mounted on three truck wheels and equipped with a handle for convenient movement about the shop. The top plate which supports the draft gear is pin connected to four pairs of hinged steel bars, one end of each pair being connected to the truck frame and the other carrying a flanged roller which moves horizontally on the truck frame. The two front rollers are interconnected by being mounted on the same shaft and the same is true of the two rear rollers. As the front and rear rollers are drawn together, by lever and worm-gear connections from an air motor mounted under the truck frame, it is obvious that the top plate supporting the draft gear will rise and similarly the top plate and draft gear will be lowered as the front and rear rollers separate. The usual rubber hose connection is made to the air motor which is operated by the convenient hand lever and connecting links shown in the illustration. The motor is, of course, reversible to permit either raising or lowering the draft gear.

This device is not only a great time and labor saver in removing or applying draft gears but has considerable value from a safety standpoint, also, since it eliminates the hand blocking and jacking formerly required in the restricted space under the draft gear pockets and practically avoids the necessity of car men going under the car except to guide the draft gear and coupler yoke into place and to apply the retainer plate and bolts.

The third device consists of a home-made pipe-cutting machine which is relatively simple to construct and oper-



Portable device equipped with an air-driven lift for removing and applying draft gears

ate and can be readily located at any point about the shop where a considerable amount of pipe cutting has to be done. The steel frame of this machine supports a top plate on which is mounted a pair of rollers which revolve the pipe during the cutting operation, these rollers being driven from an air motor built into the base of the machine and having an operating handle conveniently located at the front, as illustrated. The V-plate support for the outer end of the pipe is shown at the left of the machine, also the stop bar or gage used when cutting a

number of pieces of pipe to the same length. This gage is positioned longitudinally on a round supporting bar at the rear of the machine, being held in any desired position by means of a set screw.

The actual operation of cutting the pipe is performed by a single roll cutter in a horizontal cutter bar, hinge-



Simple and effective home-made pipe-cutting machine which has a capacity to cut up to 2-in. pipe

connected to a vertical post at the back of the machine, and arranged so that suitable pressure on the cutter can be developed by a hand lever at the front of the machine, as illustrated. A light coil spring is used to raise the cutter bar and cutter after each pipe cut is made. Provision for keeping the cutter well lubricated is made by means of the oil cup illustrated. The machine can be used for cutting up to 2-in. pipe, the horizontal cutter bar and cutter being raised or lowered, dependent upon the pipe size, by means of a small hand-wheel and screw built into the vertical supporting post at the back of the machine, as shown in the illustration.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

166—*Q.—How is the speed governor control for the HSC affected when the Diesel locomotive is detached?* A.—This is automatically cut out as the circuit is broken from the 64-volt locomotive battery.

167—*Q.—What takes place in the train?* A.—The contactors on the first and last cars are de-energized.

168—*Q.—What movement takes place at the F and F.S. 1864 relay valves?* A.—The magnets of the relay valves are de-energized and their valves assume the positions shown in Fig. 18. The H.S. and M.S. magnets open diaphragm cavities *P* and *N* to inshot pressure only, while application air is effective on diaphragm *64*.

169—*Q.—How does this diaphragm affect the amount of brake cylinder pressure obtained?* A.—As this is a 60 per cent diaphragm, the relay portion operates to produce this ratio of brake cylinder pressure to displacement reservoir pressure built up in cavity *K*.

170—*Q.—What does the maximum braking ratio thus produced correspond to?* A.—Standard steam road practice which permits operation of the cars in automatic service controlled by the standard ET locomotive equipment.

171—*Q.—Are there some installations in which the operation of speed governor control of maximum braking pressures is effective when the train is operated by a steam locomotive?* A.—Yes, in some installations speed governor control is retained for automatic service by shunting the contactors, which nullifies their function. Car battery supply thus remains connected for the operation of speed governor relays.

Speed Governor Control

172—*Q.—What is the basic principle of speed governor control?* A.—Referring to the wiring diagram (Fig. 14), it is the use of a generator attached to the axle of one pair of wheels of a car, the voltage of which is proportional to wheel speed, and the use of relays which operate at a generator voltage corresponding to certain speeds, which in turn cause operation of other devices, designed to provide braking force suitable for use at such speeds.

173—*Q.—What does the speed governor equipment include?* A.—A relay cabinet (Fig. 9) and an axle generator (Fig. 10) mounted on one axle, the car at each end of the train being so equipped.

174—*Q.—To what does the generator supply current?* A.—Referring to Fig. 14, generator *11* supplies current to a directional relay *1*, a directional repeater relay *5*, and the three speed governor relays *2L*, *2M* and *2H*.

175—*Q.—What is essential in regards to the current direction as it flows from the generator to the three-speed governor relay?* A.—That the current flows in the same direction regardless of the direction of travel of the vehicle.

176—*Q.—How is this provided for?* A.—The directional relay is used to detect the direction of travel of the vehicle, and its contacts position themselves accordingly in order to provide current flow in the right direction through the remaining relays.

177—*Q.—What means are provided to protect the battery against possible draining during the time the brakes are not applied?* A.—The *K-3* switch of the F.S.-1864 relay valve, located in the battery circuit, is open until a predetermined brake application pressure is developed.

178—*Q.—Describe the current flow when the car begins to move in a forward direction.* A.—Current from the generator will flow through wire *21*, upper and lower coils of relay *1*, contact *5-A* of relay *5*, test jack *72-64* and wire *22* to the other side of the generator. Relay *1* is so designed that with current flowing in the direction described, its contact will be closed in the upper position. With relay *1* so energized, current from generator will also flow through wire *21*, contact *1-A* of directional relay *1*, resistor *7*, upper coil of relay *5*, contact *1-B*, through test jack *72-64*, and wire *22*, to the other side of the generator.

179—*Q.—What prevents over-energization of the relay as the car speed increases?* A.—When the car reaches a speed of approximately 8 m. p. h. the current flowing through the upper coil of relay *5* will be sufficient to operate this relay to the energized position, opening contact *5-A*. Opening of this contact removes the generator current from relay *1*, thus reducing the load on the generator and preventing over-energization of relay *1*.

180—*Q.—Do the contacts of relay 1 remain in the position assumed during energization of the relay?* A.—Relay *1* is so constructed that its contacts will remain in the position assumed, even though the coil then becomes de-energized.

Brake-Beam Supports Missing on Tank Cars

In a circular letter recently issued by the A. A. R. Mechanical division, V. R. Hawthorne, executive vice-chairman, reports that the inspectors of the Mechanical Inspection department have found in excess of 100 recent cases of tank cars, both loaded and empty, being forwarded in road movement with brake-beam safety supports or bottom rod supports broken or missing. These supports are required as safety devices to prevent brake beams from falling to the track.

Interchange Rule 3, Sec. (b), Par. (8) requires these devices on all freight cars by January 1, 1944, to be acceptable from owners for interchange movement. Mr. Hawthorne says that every effort should be made to maintain these devices on all interchange freight cars and particularly tank cars. He urges that, before tank cars are placed for loading or after being unloaded, these devices be inspected and repaired or replaced.

Restoring Worn Truck Columns and Bolster Guides

In a circular letter, recently issued by the A. A. R. Mechanical Division, attention is called to the worn condition of truck side-frame columns and column guides on truck bolsters and the various methods used for building up or restoring these surfaces for cast-steel bolsters and truck side frames.

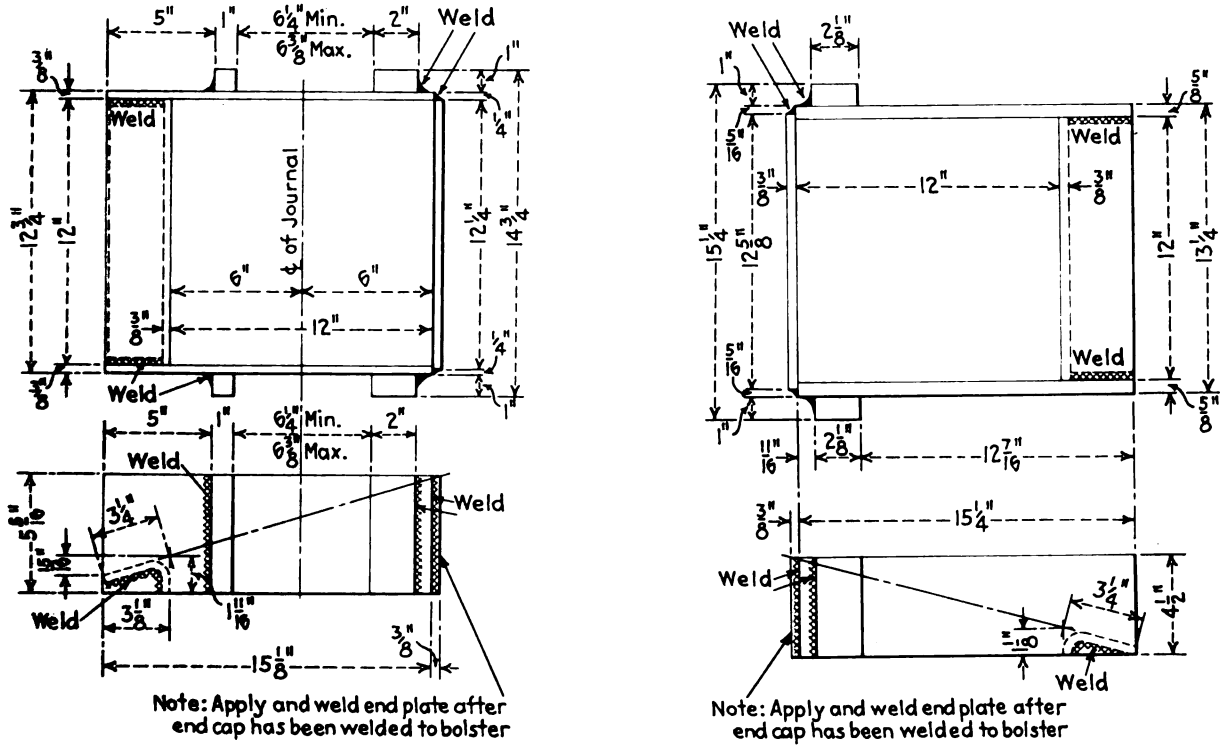
The letter explains that, under A. A. R. Interchange Rule 23, the building up of worn surfaces is permitted, providing the material remaining in the part is equal to 60 per cent of the original section. The rule also specifies that heat treatment is not required either on the cast-steel bolster or within the shaded area shown on Fig. 14 which includes the columns and column guides.

In most cases the worn surfaces on cast-steel truck bolsters and side frames can be restored by building up the surfaces by welding, and due to the frequent uneven wear this is said to be the preferable method.

In cases of extreme wear and when found impractical to restore the worn surface entirely by welding, it is recommended that the irregular surfaces be lined up and welding performed where necessary prior to the application of steel wear plates of suitable thickness, these wear plates being secured by welding.

Pressed and structural-type bolsters including the Simplex type, Bath-tub type, Huntoon and others are being gradually replaced by cast steel. The circular letter calls attention to the fact that, on most of these bolsters, column guides are provided with separate end caps made of pressed steel, malleable iron or cast steel, built-up construction being sometimes used. In most cases, it is the practice to replace these separate worn parts with new parts in preference to building these up by welding; however, where cast-steel end caps are used the surface can be restored by welding. It is permissible to replace the end caps with built-up parts of welded construction similar to the accompanying drawings which were included with the circular letter and represent two typical examples.

When worn surfaces are being restored the letter says it is important that the relation between the side frame and bolster be maintained as near as possible to the original condition without attempting to take up the entire wear on either the truck side frame or the bolster which would destroy the interchangeability of these parts.



Built-up welded end-caps for Simplex-type bolsters—50-ton car (left); 40-ton car (right)

Ladder Device for Applying Side Sheets

One of the accompanying illustrations shows the former method of applying metal side sheets to box cars by the use of a gasoline-driven tractor equipped with a swinging crane or boom which is highly flexible in operation and will lift and move any heavy car materials within its capacity at any level from the shop floor to the top of a box car. The particular operation shown consists of applying a metal side sheet to Ilinois Central box car No. 32210 which is undergoing repairs at the I. C. car shops, Centralia, Ill. The only difficulty with this job is that it ties up a crane-equipped tractor while the metal side sheet is being secured in place and, not only that, but the tractor is not always available exactly when needed owing to urgent demands for this valuable ma-



Former method of using a crane truck and platform ladder in applying metal side sheets to box cars

terial-lifting and moving device at many other points throughout the car shops. The result is that the time of at least one car man and helper is more or less wasted while waiting for the crane truck.

To avoid this loss of time, a simple welded steel ladder with an angle iron cross bar at the top, to which a chain and hand-operated jack connection can be made to the metal side sheet, is used for easily raising or lowering the sheet to the exact position required for riveting. This particular device was the idea of an Illinois Central car man welder, A. L. Foutch at Centralia, who received $25 and an Award of Individual Production Merit for his suggestion. According to the Illinois Central Magazine, which first described the device in its January, 1943, issue, the idea has also been referred to the War Production Board in Washington with recommendations for higher award and extension of the plan to other roads.

Referring to the second illustration, it will be noticed that the ladder itself is constructed of light angle side



Ladder and hoist device which permits applying side sheets without waiting for a crane truck

pieces and cross bars, fabricated by welding. The chain connection to the metal side sheet is made by means of a steel strip bolted to the lower part of the sheet at one end and engaging a hook on the chain at the other. The hand jack (in this case a Coffing hoist) can then be used to give fine adjustments in position of the side sheet required for the application of fitting-bolts, reaming the bolt holes and riveting. A further advantage of this device is the small amount of floor space required and the fact that the sheet can be held in position as long as required without tying up a crane-equipped tractor. In addition to speeding up the particular job of renewing side sheets, releasing the crane truck has also had the effect of expediting shop work and releasing freight cars for service in a shorter period of time than would otherwise have been possible.

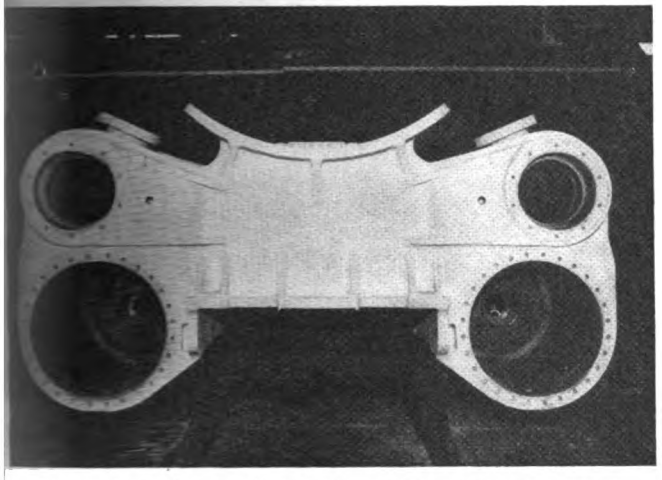
Mr. Foutch's suggestion was: "I suggest that a ladder device be adopted for raising metal side sheets on box cars for the following reason: It can be operated by two men more effectively than by the 'mule,' inasmuch as it can be more properly aligned by a slight pressure of the hand, whereas the 'mule' with its mechanical power in some cases, should it be obstructed in any manner, might cause disastrous results." It is evident from the photographs that this recommended practice, simple as it is, has in it time saving merit. More of such suggestions would be useful in all railroad shops and might possibly help in overcoming other simple problems of production

Welding Locomotive Cylinders*

By Carl Ray Averitt

In building one-piece welded locomotive cylinders three important factors must be considered, namely, maximum utility, convenience and economy. This required much thought and careful study by the design men but resulted in simplification and reduction in the amount of welding required. The material chosen was a mild steel of low carbon content which had excellent weldability. Proper electrodes were specified and qualified operators selected.

One hundred and twenty-nine parts were needed. They were cut to shape and scarfed for welding by the oxy-acetylene process on a machine designed for such work. When the plate material was cut it was sent to the blacksmith shop for all bending required. This work was done in a large hydraulic sectional flange press after the material had been pre-heated in an oil furnace.



Completed cylinder which required 3,083 man-hours of labor

Welders were chosen from among trained men, who, are tested periodically for ability and workmanship. These men are coached and taught the use of proper electrodes, as to size, type and analysis. Proper technique in the selection of the type of joint, current control, positioning, pre-heating (when necessary) and heat treatment of finished work is taught.

Welding Procedure

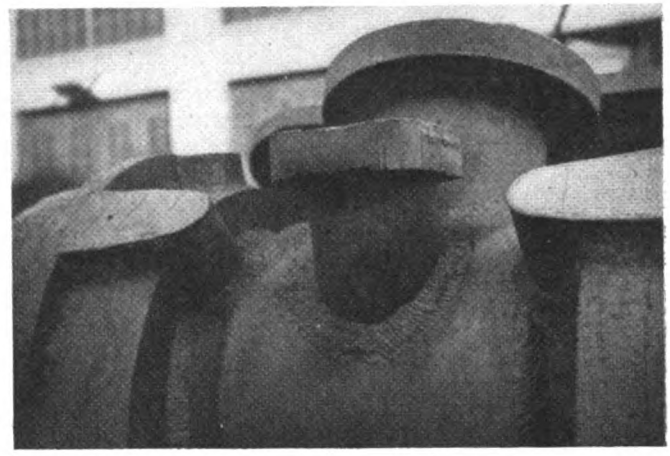
After two welders for each of the three working shifts had been selected to fabricate the cylinders, the various parts were then set up and made ready for welding. Some parts such as the steam chests and cylinders required fabrication themselves before the complete cylinder could be set up. Welding had to be completed on the inner surfaces before the final pieces could be applied.

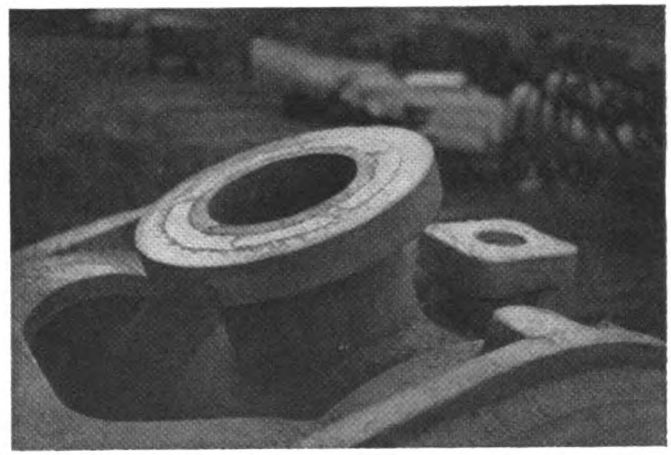
The contraction due to heat set up by the weld metal had to be allowed for in setting up all parts. One-quarter inch was allowed in the length and 1/8 in. in the width and these allowances proved to be very accurate. The parts were held in place by spacers and bracing bars to withstand strains of contraction and pulling and to

Cost Production Figures for One-Piece, All-Welded Cylinder for Passenger Locomotive

Labor	Man-Hours	Cost
Blacksmith	338.50	$ 257.24
Welding	1,559.06	1,402.18
Machine	1,176.01	795.39
Other	9.30	8.04
Shop expense	....	763.51
Total	3,083.27	$3,226.46

Material Welding Rod, in.	No. of Rods	Weight, lb.	Cost
3/16	6,777	1,093.0	$69.73
1/4	3,604	1,001.1	57.56
5/32	3,366	336.6	31.03
Total	13,747	2,430.7	$148.32
Steel used (including two cylinder heads)	....	....	$762.91
Oxygen used for cutting	....	....	16.65
Miscellaneous	....	....	13.19
Total, all material	....	....	$941.07
Total cost, labor and material	....	....	$4,167.53
Total cost of cast-steel cylinder	....	....	$5,137.55
Total savings	....	....	$ 983.21
Total weight of fabricated cylinder (includes bushings and cylinder heads), lb.	15,352	....	....





Details of welding shown before sand blasting

* Abstract of a prize-winning paper submitted in the recent $200,000 Industrial Progress Award Program of the James F. Lincoln Arc Welding Foundation.

insure proper alignment. Care was taken in the welding to keep procedures uniform.

Finishing Operations

After welding had been completed the cylinder was placed in an oil-heated furnace and raised to a temperature of 1,550 deg. F. to relieve stresses and produce a uniform grain structure in the steel. After having been normalized the piece was sand blasted and sent to the shop for machining. This included the machining for bushing applications, finishing the steam chest, machining the smoke-box saddle, drilling and tapping for the cylinder bead studs and machining of the cylinder-head seats.

Cost figures for materials and the various labor costs are shown in the accompanying table.

Questions and Answers On Welding Practices

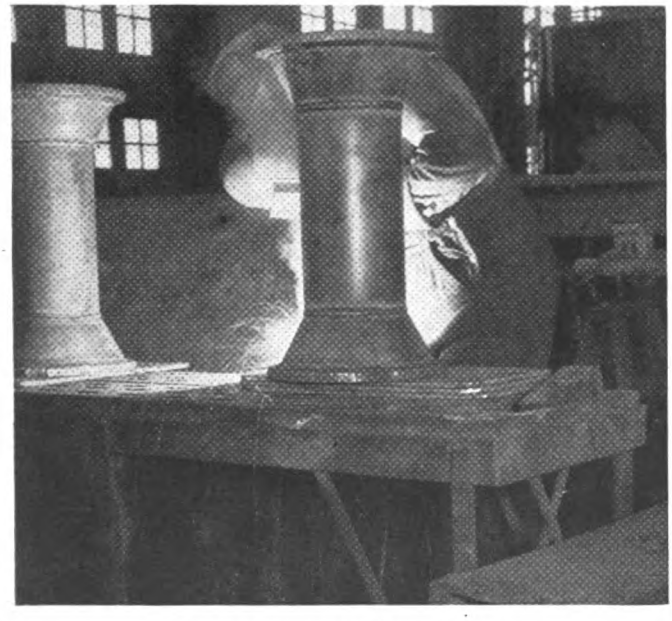
(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Cracked Valve Spools Repaired by Welding

Q.—What method do you suggest for reclamation of cracked valve spools?

A.—A simple method of repairing cracked valve spools is to melt out the fracture, preheat with a large welding head to a dull red and weld with cast-iron rod. However, it is a simple matter to make a new spool out of scrap superheater flue and small pieces of plate, welding the parts together. These all-welded steel spools give no trouble and because of the smooth surface do not seem to gather carbon as rapidly as the cast-iron type.

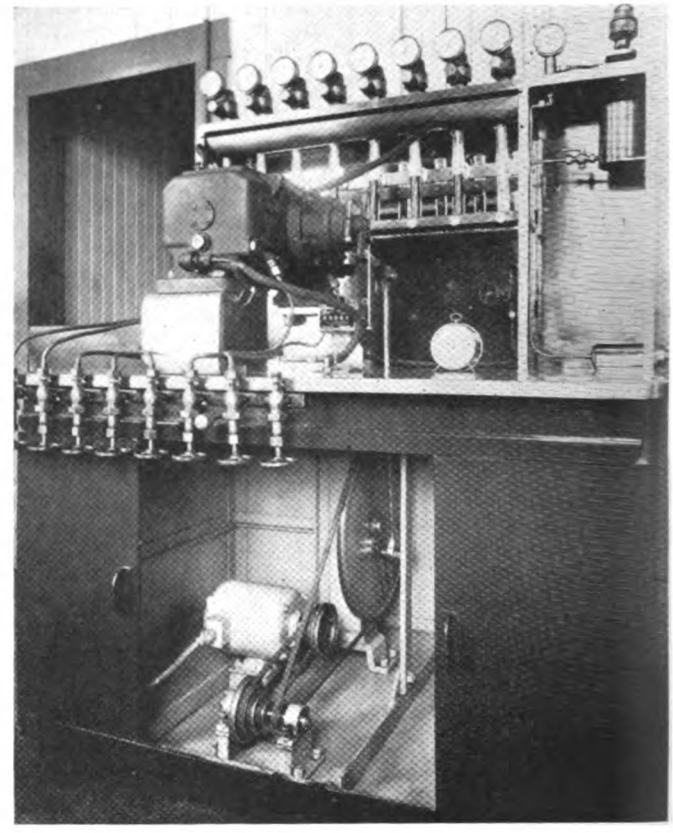
If the required diameter of the straight center section is too large to use superheater flue, roll up a piece of $\frac{3}{16}$-in. plate and weld the seam. The flared ends are made from $\frac{3}{16}$-in. or $\frac{1}{4}$-in. plate and are bent similar to the cast one they are to replace. Two discs of $\frac{3}{4}$-in. plate are flame cut large enough to machine to the correct diameter of the spool and these are welded securely to the flared sections. When this assembly is complete the ends are machined to the same dimensions as their cast counterparts and a long wearing, good looking valve spool is the result.



Fabricating valve spools by welding

Test Rack for Mechanical Lubricators

The mechanical lubricator test rack, illustrated, is used at the St. Louis-San Francisco locomotive shops, Springfield, Mo., to indicate the pressure on the terminal checks and the necessary adjustment of the various feeds, with a predetermined count and stroke at a temperature of 140 deg. to 150 deg. F.



Lubricator test rack used at the Springfield, Mo., locomotive shops of the St. Louis-San Francisco

The rack is equipped with nine terminal checks, each located above a measuring cylinder of four liquid ounce capacity, graduated in drams ($\frac{1}{16}$ of a fluid ounce). A drip pan of sliding construction is located above the measuring cylinders which can be brought forward above the cylinders to prevent further flow of oil to the cylinders when necessary during a test. A reduction counter registers the count which represents a revolution of the driving wheel.

The illustration shows the electric drive arrangement and indicates how the eccentric may be adjusted to the required stroke, the same as that obtained from the

lubricator drive on the locomotive with the valve gear set at the prescribed cut off. The lubricator feeds are connected to the terminal checks with ⅜-in. O. D. copper tubing having a ⅜-in. angle valve permanently located on the rack.

A steam heat line is connected to the lubricator to provide the required temperature of the oil, using a laboratory thermometer. The motor is equipped with a rheostat control which may be adjusted for the desired speed.

Having the count, length of stroke, and the feeds to the cylinders, valves and pumps given, it remains to adjust the feeds, with the arm on the eccentric set for the desired stroke.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Mud Rings Repaired by Welding

Q.—Is it necessary to remove the mud ring from the boiler when repairing a cracked or broken mud ring? What is the recommended procedure for making such repairs?—W. I. R.

A.—Cracked or broken mud rings can be repaired by either electric or oxyacetylene welding without removing the mud ring from the boiler. A portion of the firebox side sheet at the point of the crack is cut away, exposing the mud ring for a sufficient distance so that the mud ring can be veed out at the point of the crack or break. The mud ring should be veed out from the top, the vee extending the entire width and depth of the mud ring. Weld metal is then deposited in the vee. Care must be taken to insure proper fusion between the deposited weld metal and the mud ring. Continue until the vee is filled with weld metal and reinforce the weld on the top.

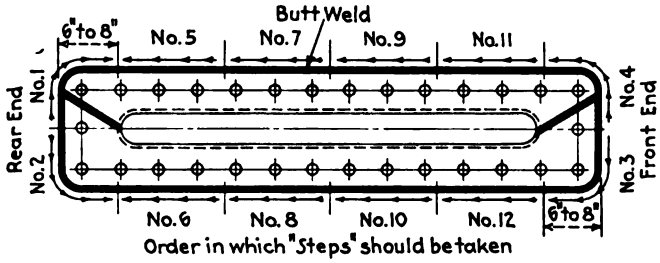
After the repairs to the mud ring have been completed, a suitable butt-welded patch is applied to the side sheet where the section was cut away. All firebox ring rivets removed are reapplied to complete the repair. Where the mud ring is removed from the boiler, the same procedure of welding cracked or broken mud rings is followed except that the mud ring is veed out from both the top and bottom of the crack and the top and bottom vees are welded up at the same time by two welders.

Welding Thermic Syphons

Q.—What is the best method of welding Thermic syphons to the crown sheet of a locomotive boiler?—J. T.

A.—Any method of welding syphons to the crown sheet that will properly provide for expansion and prevent creeping as the welding progresses is satisfactory.

The step-back method is suggested, and can be used with either the electric or oxyacetylene process. Plates should be properly clamped and braced to prevent undue movement and distortion. The ends should then be welded; beginning at No. 1 on the diagram, coming around the corner from 6 in. to 8 in. Follow with No. 2, then 3 and 4 at the front end, then back to 5, etc.,



going an equal distance on either seam to distribute the stress. The length of steps depends on the rigidity of the sheets. Where radial staybolts have been applied in the crown sheet, the steps should be from 12 in. to 14 in. long; where radials have not been applied, the steps may be longer.

Reinforcement Of Reverse Gear Bracket

Q.—A reverse-gear bracket is to be applied to the side of a boiler with five 1-in. studs. The studs are staggered, with two studs in the top row and three studs in the bottom row. They are spaced 7 in. apart and the distance between the two rows of studs is 2½ in. Should the shell course be reinforced behind the reverse-gear bracket due to the application of these studs?—F. E. C.

A.—The shell course should only be reinforced if the efficiency of the shell plate through the stud holes falls below the efficiency of the shell course to which the bracket is attached. The efficiency through the stud holes is the relation of the strength of the shell between the stud holes as compared to the strength of the solid plate for the same distance.

For the conditions outlined in the question, the total distance over the studs can be considered to be 4×7, or 28 in.

The diagonal distance between any two studs would be

$$\sqrt{(7)^2 + (2.5)^2} \text{ or } 7.4 \text{ in.}$$

The solid plate between any two studs would be the diagonal distance between the studs minus the diameter of the studs or

$$7.4 - 1 = 6.4 \text{ in. of solid plate between stud holes}$$

The total amount of solid plate between the two end studs would be

$$6.4 \times 4 \text{ or } 25.6 \text{ in.}$$

The distance between the two end studs is 28 in.

The efficiency of the shell between the two end studs would then be

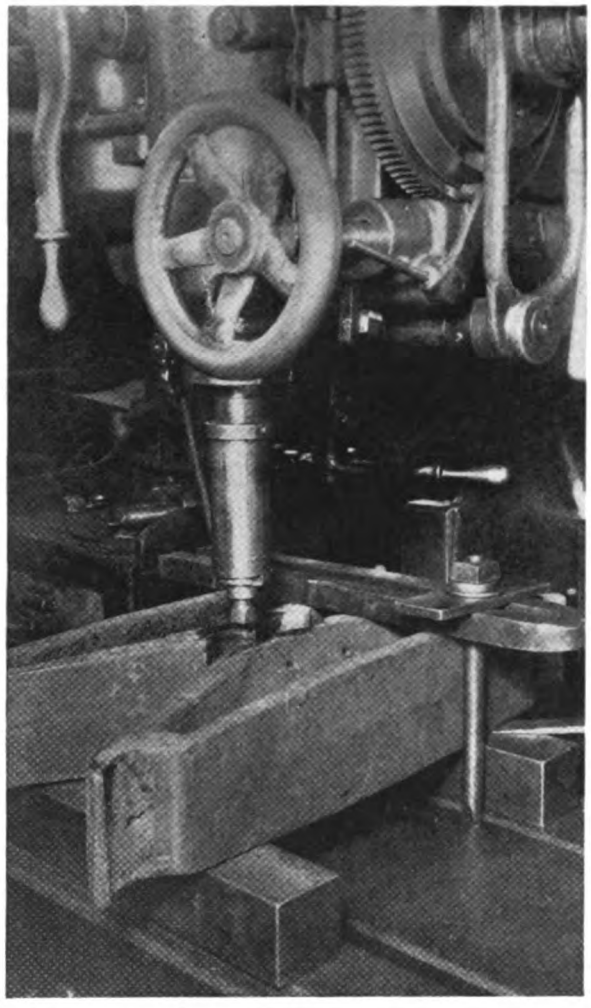
$$\frac{25.6}{28} \text{ or } 91.4 \text{ per cent}$$

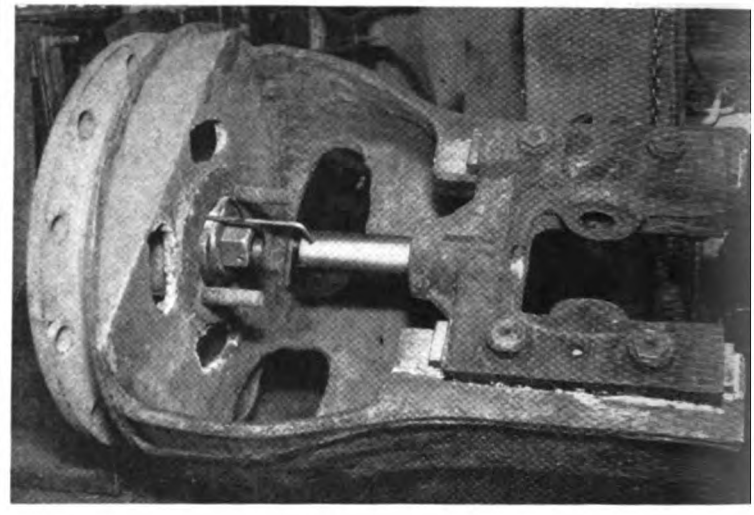
The thickness and the tensile strength of the plate being the same for both conditions, same can be cancelled out.

Should the efficiency of the course to which the bracket is applied be greater than 91.4 per cent, the shell course would have to be reinforced.

Time Savers on the Santa Fe

Six jigs in use at the Topeka locomotive shop

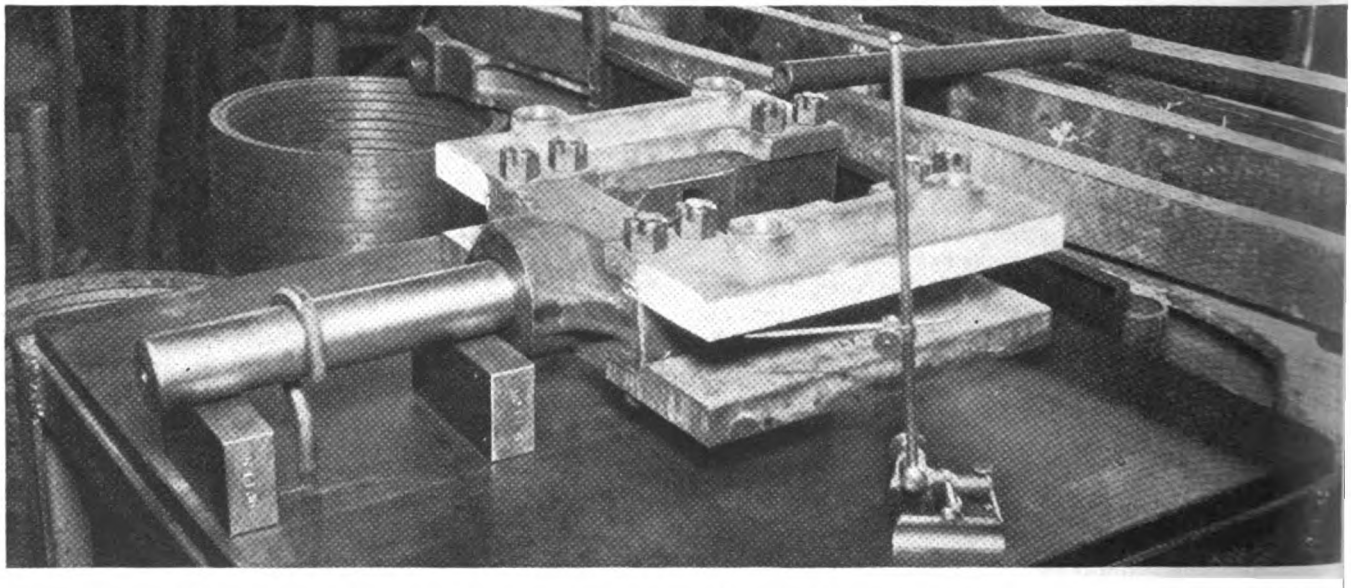




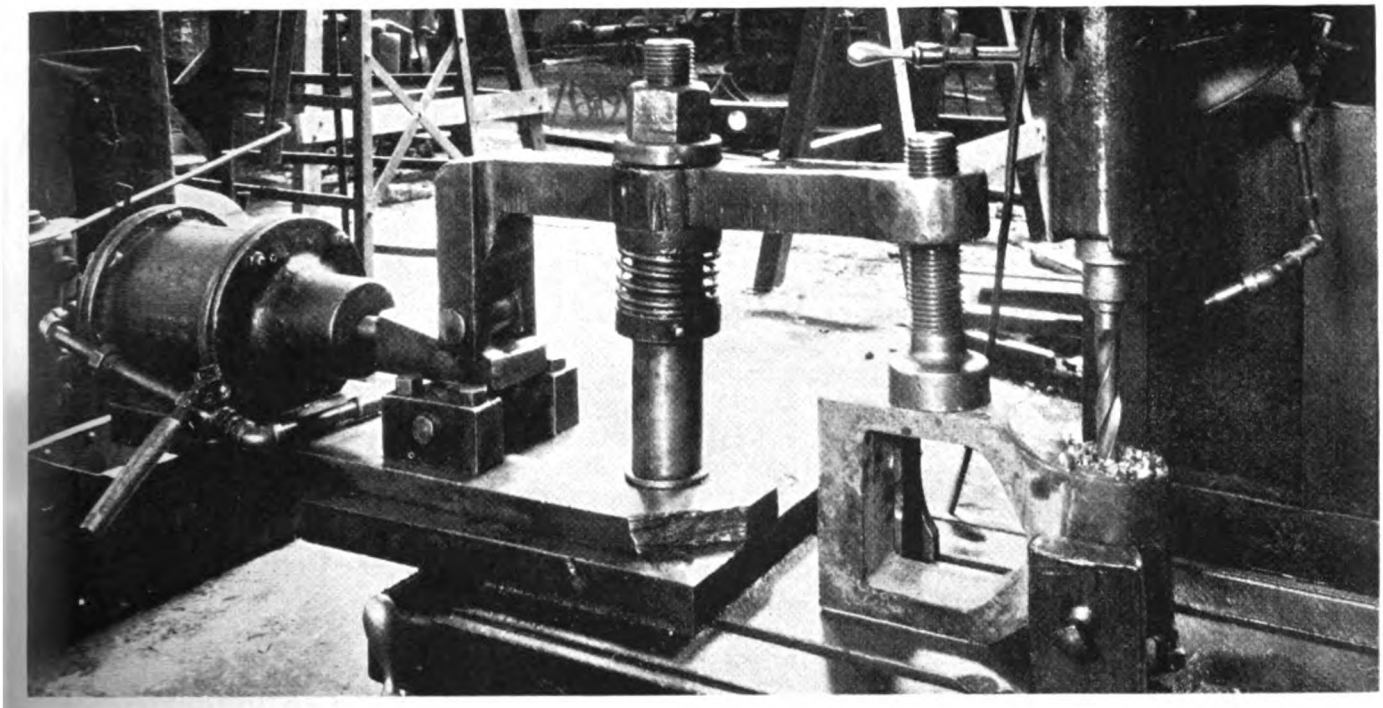
Above: A jig for lining valve-stem crossheads—The valve-stem crosshead is fitted with a stub valve stem which carries a fishtail tram—By revolving the stub valve stem in the crosshead it is possible to line the crosshead central with the stuffing box—Time saved, 18 min. per crosshead—An angle bracket supports the valve-chamber heads on the bench

◆

Left: A jig for boring tender-truck equalizers when machining the equalizer seats and the spring shackle seats in pairs, either new or after building up by electric welding—Time saved, 10 hrs. per locomotive set



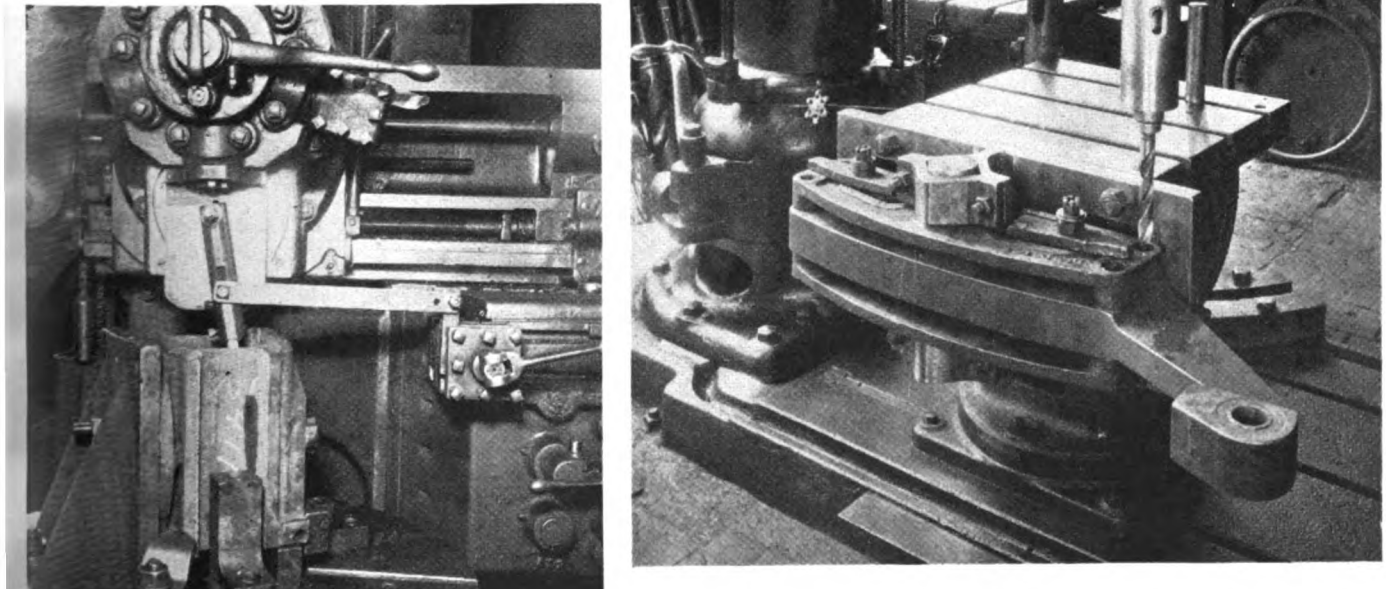
A jig for laying out valve-stem crosshead liners—It consists of a face plate, 30 in. by 30 in., mounted at work-bench height; two parallel blocks, 1½ in. by 2¾ in.; a J-bolt, and a stub valve stem of suitable length—The liners are bolted in place on the crosshead and the valve stem is driven in and secured on the parallel blocks by the J-bolt—With a surface gauge the edges of all four liners may be laid off at one setting—Time saved, 24 min. per crosshead

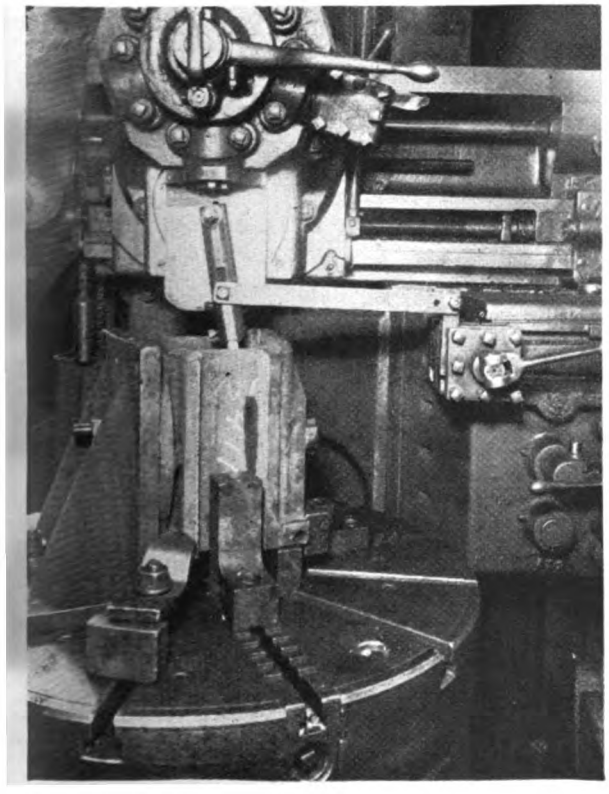


Above: An air clamp for a vertical drill press—It is used for holding special work, including spring-rigging parts, on a drill-press table—The level type clamp and adjustable holding screw are actuated by a suitably mounted air-cylinder and taper steel wedge applied to the end of the piston rod—Average time saved, 1½ hrs. a day

◆

Below: Jig for turning ball seats for equalizer-bearing pads in the top of Batz-Lanning engine-truck boxes—It consists of a suitable bracket for supporting the box on the boring-mill table, a hinged tool post and cutting tool, and lever connection to the side tool head of the machine—Time saved, ½ hr. per box





Above: A jig for drilling and reaming the bolt holes through Walschaert valve-motion links and link plates—The jig consists of a base and two V-blocks—The base, which is vertical, is bolted to the side of the drill-press table—The V-blocks, which are parallel and in line, are welded on the base—These receive the trunnion bearings which are held in place by clamps bolted to the V-blocks—The link and trunnion plates are held together with two bolts and clamps—Time saved, 36 min.

Preventive

Maintenance of Motors

By J. T. Pringle*
and
W. W. McCullough†

Motor stockpile can be sustained and work interruptions avoided if a few simple rules are observed

ALTHOUGH they do not actually move freight and passengers over the rails, the electric motors in railroad shops and terminals properly maintained will prevent delays to train movements.

The failure of a turntable tractor motor could cause an appreciable delay in moving a fresh locomotive to the ready track. A pumping plant, coaling or compressor station must have its motors in working order or serious train delays will result. Railroad facilities are being worked harder than ever before, therefore every precaution must be taken to prevent motor failures. That is where *preventive* maintenance pays dividends.

The ideal motor maintenance program aims at prevention of breakdowns rather than their repair. Maintenance involves competent, periodic and systematic inspection. A thorough survey of each motor installation should be made and a systematic inspection and maintenance schedule established and enforced.

Records must be kept consistently on the schedule selected. Several excellent record systems have been developed and reduced to printed form, so that it is not necessary to go to the trouble and expense of devising individual systems.

Prevention of breakdowns may be helped by a thorough analysis of the equipment involved. For example, if the difficulty is the frequent tripping of overload relays, it may be the installation of a different type of relay with thermoguards on the motor will enable the motor to carry the loads without an injurious temperature rise. Complete replacement of certain obsolete units may be called for, or it may be that in a blacksmith shop replacement of one large blower by individual blowers is required. Possibly, the addition of one or more jib cranes in a shop would relieve overloaded crane facilities.

Maintenance Schedules Should Include Systematic Inspection

It is impossible to give any hard and fast rules for frequency of inspection. The following suggestions are based on average conditions.

Once a week check oil level in the bearings and see that the oil rings are moving freely. Check the temperature of the motor bearings and primary iron with the hand. Sniff the warm air coming from open motors. The fumes emanating from overheated insulation are unmistakable.

Once a month check the brush holders, brushes and shunts. Blow out the motor with compressed air. This may have to be done more often in roundhouses, on coal, sand and ash handling equipment where there is excessive fine dirt.

Once a year check air gap with feeler gauge. Check insulation resistance with a Megger. Check line voltage with a voltmeter, and load with an ammeter. Equip critical motors for socket type ammeters so that load can be readily checked. Clean out and replace grease in ball and roller bearings. Check renewal parts stock in light of the past years' experience and order replacements from the motor manufacturer.

Every two years dismantle the motor. See that all windings are tight. Replace loose wedges and loose bands before dipping in varnish and baking. Inspect commutators and commutator connections. Sleeve bearings require no flushing. At intervals of about 2 years in average service, or during general overhaul periods, remove the bracket and wash out the bearing housing. Use hot kerosene oil and compressed air if available.

Faulty Bearings Cause Most Motor Failures

All motors depend upon a mechanical assembly of some sort for the transformation of electrical energy into mechanical energy or work. The bearings are a very important link in this mechanical assembly.

Bearings probably cause more shutdowns, delay and expense, than any other cause. This is not surprising, when it is remembered that they are victims of poor foundations, misalignment, vibration, thrust from couplings, dirt under and over lubrication, and frequently the wrong lubricant; all this in addition to their real job of supporting a rapidly revolving part.

The first requirement of successful bearing operation is lubrication. This entails more than just an adequate supply of lubricant; the lubricant, the bearing design, and its condition, must be correct.

Proper Lubrication Dissipates Heat in Bearing

Sleeve bearings sustain the essential oil film to prevent metal-to-metal contact between the shaft and the bearing

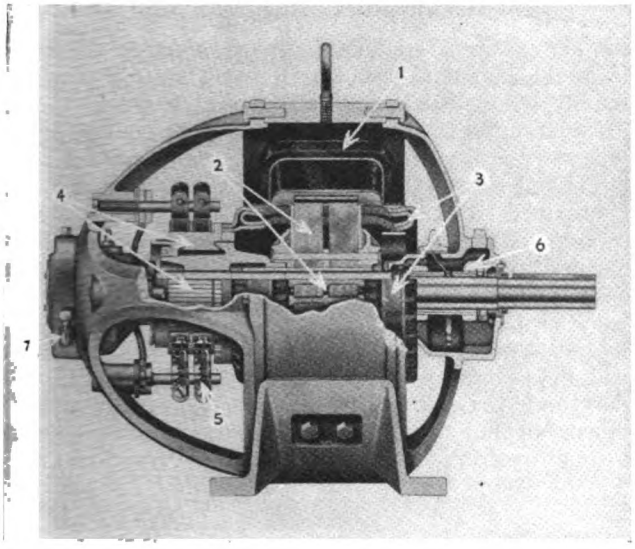
* Transportation dept., Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
† Maintenance engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

surface. Properly designed bearings have adequate area for the load, proper oil grooving, working oil rings, and suitable materials.

Safe operating temperature for bearings under normal operating conditions is considered to be 40 deg. C. rise above the surrounding room air. At this temperature a bearing feels only comfortably warm to the hand. Assuming proper mechanical condition of the bearing, whether sleeve or ball, and the bearing assembly, and assuming that proper lubricants are used, temperatures elevated above 40 deg. C. call for immediate investigation.

Oil Film Lubricates Sleeve Bearings

In a sleeve bearing the oil sticks to the shaft and is dragged along by the rotation of the shaft so as to form a wedge-shaped film between the shaft and the bearing. This film of oil carries the load, and prevents metal-to-metal contact. So long as this film is established and



Cutaway view of a d.c. motor—1, field coils; 2, armature; 3, armature coils. 4, commutator; 5, brush rigging; 6, sleeve bearing; 7, oil overflow and filler plug

maintained there is no metal-to-metal contact in the bearing while the shaft is rotating, and, therefore, no perceptible bearing wear.

Two outstanding considerations govern the maintenance of sleeve bearings. First, is to insure the existence of the oil film once rotation has begun. *Use the right oil.* The second is to minimize the destructive effects of metal-to-metal contact when the film is lost, either by accident, or during the starting period. *Use the right babbitt.*

For sleeve bearings, proper maintenance keeps the oil well filled to the proper level and the oil rings turning freely. New oil should be added only when the motor is at rest to prevent overfilling of the reservoir. Oiling of bearings is more often overdone than underdone. Sleeve bearings which require frequent refilling and thereby leak oil onto the stator windings should be replaced with sealed sleeve-type brackets and bearings.

Oil rings generally carry far more oil than is necessary for proper lubrication of the bearing. When running, most of this oil is carried on the outside diameter of the rings by centrifugal force. This excess oil causes splashing and spray inside of the bearing housing. Air currents that pass through the housing pick up this spray and deposit it on motor windings. Sealing the bearing against the entry of air currents is therefore necessary and is accomplished in all modern designs by close tolerances, felt seals, and air by-passes to offset blower action of rotating parts.

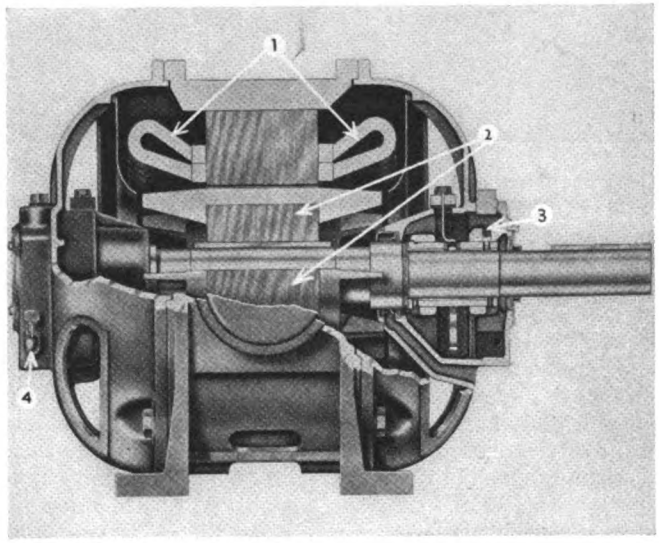
The purpose of the felt washer in these seals is often misunderstood. The real purpose of the felt is to keep out air and dirt. In itself it has little value for preventing leakage of oil once it becomes oil soaked. Bearing wear, which means radial movement of the shaft, spoils the effectiveness of the bearing seals. Replace all felt seals at the same time when replacing sleeve bearings. These felt seals should be ordered from the manufacturer of the motor. If it is necessary to make them in an emergency, use high-grade felt not less than ¼ in. thick before compression. Make the inside diameter of the washer the same as the shaft or slightly less. Cut the felt true with edges at right angles to the surface of the felt.

Oil leakage is generally aggravated by high temperatures. Keep bearings cool and use an oil that does not foam easily.

Clicking Sound May Indicate Ball Bearing Trouble

Ball bearings have become increasingly important with the use of totally inclosed and fan-cooled motors. In a sleeve bearing, as just explained, the shaft when in motion is separated from the bearing by the oil film. In a ball bearing, a series of steel balls act as the separating medium, both when the motor is stationary and when it is running.

To keep the steel balls uniformly distributed around the bearing a cage or retainer is used, each ball having its own pocket. The balls have rolling contact with the raceway, the sliding contact with the surfaces of the retainer. This means that lubrication is necessary.

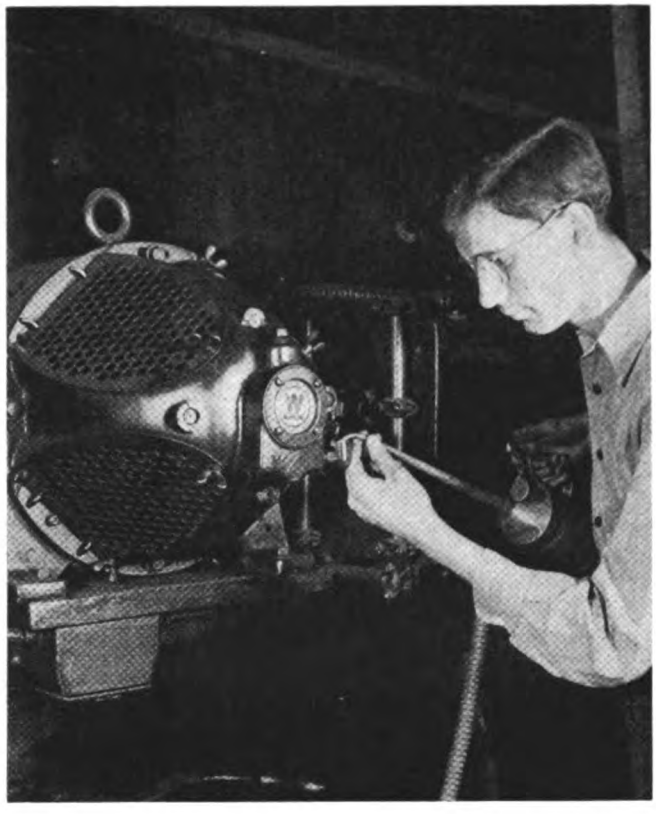


Cutaway view of an a.c. squirrel cage motor—1, stator coils; 2, squirrel cage rotor; 3, sleeve bearings; 4, oil overflow and filler plug

Most ball bearings used in horizontal motors are grease-lubricated although some supplied with vertical motors use oil. Follow the advice of the motor manufacturer in selecting a suitable grease. Carelessness in allowing containers to remain open causes trouble from abrasive dirt. Soda-base soap greases are usually preferred on account of their high melting point and their stability. They mix readily with water, however, and tend to form an emulsion.

Ball bearings in distress can usually be detected by undue heating or by unusual noise. Broken or nicked balls cause rapid destruction of the bearing. They can be detected by the clicks.

If the conventional 40 deg. C. rise above the surrounding air is exceeded, look for an overfilled bearing, since the first result of over-greasing is heating caused by churning of the grease. The general rule is that the housing should not be over half full. Clean the old grease from the bearing and from the housing once a year and replace it with new grease. Average service is assumed.



Oiling the motor regularly is essential to the long bearing and shaft life—Too much oil may contaminate the motor windings, causing possible deterioration of the insulation

After the machine is dismantled, the bearing should be carefully wrapped in clean cloth or paper to protect it from outside dirt. Remove all old grease from the housing and clean the housing and bearing either in Stoddard solvent or in carbon tetrachloride. This is a difficult operation because particles of grit are not soluble and are removed with difficulty. Remove final residue of cleaning medium with a light oil before filling with new grease. The container with fresh grease must be carefully protected from dirt. Keep the cover on tight. Use a clean, nonmetallic paddle for applying the fresh grease.

Check Air Gap With Four Readings

The air gap in a motor is dependent first on proper maintenance of the bearings and second on the proper alignment of the brackets or pedestals with the frame. Alternating-current motors operate with less gap than direct-current motors, and are therefore more critical. Check the air gap with a feeler gage at the established schedule period. Make these checks at the pulley end, taking 4 readings on each motor, 90 deg. apart. For motors below 10 hp., a minimum gap of .005 in. should be maintained. Above 10 hp. the minimum gap should be .010 in.

Couplings Require Parallel Alignment

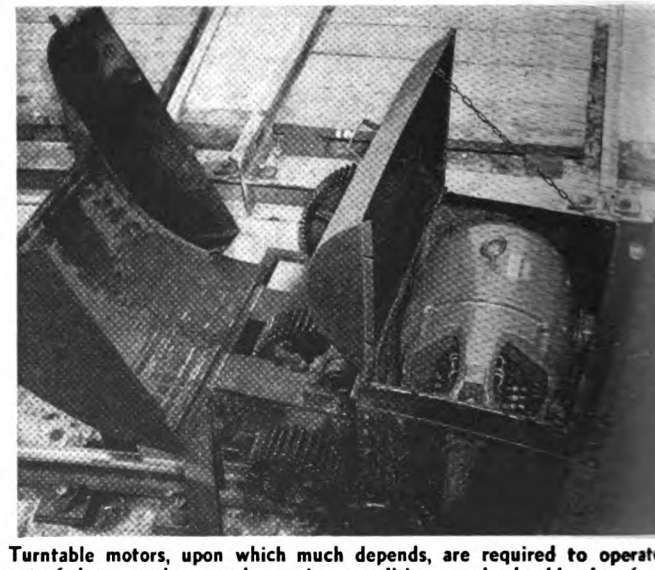
Where coupled type motors are used, the couplings require regular inspection. Faulty alignment in a solid coupling is reflected in bearing trouble and vibration. Make sure that all dowel pins are in correct position and check the faces of the couplings with a feeler gage after the bolts have been removed. Shift the motor position to make the faces of the two half couplings parallel.

Flexible couplings will operate under more severe misalignment without causing trouble; however, the two halves should be checked with a steel scale to make sure they are in alignment. Any misalignment means increased wear on the pins, fingers, and leather discs, whichever may be used. Special type flexible couplings should be checked according to the manufacturer's instructions.

Insulation Must Be Clean and Dry

The electrical conductors in a motor are separated from the magnetic circuit and from the mechanical assembly by materials generally grouped under the term "Insulation." Insulation is also used in commutators to separate the bars from each other and in coils to isolate individual turns. It is important that the insulation be maintained so as to function as a separator between the copper in the motor and the mechanical assembly. Regardless of the class of insulation used, remember that electrical insulation materials are non-conductors only when clean and dry.

The importance of keeping electrical equipment clean and dry is always worth stressing. Accumulations of dust and dirt not only contribute to insulation breakdown, but they operate to increase the motor temperature through restrictions of ventilation. Pay particular attention to motors operating in roundhouses and blacksmith shops. Dust and dirt is effectively removed with compressed air at about 50 lb. pressure. Do not direct compressed air against the insulation until it is free from moisture that may have accumulated in the air line from condensation. Too great an air pressure may loosen the binding tape or injure the insulation by sand blasting



Turntable motors, upon which much depends, are required to operate out-of-doors under rough service conditions and should therefore receive frequent inspection

with the abrasive dirt which is nearly always present. It may not be possible to remove all dust and dirt by blowing with compressed air. If the accumulation of dirt contains oil or grease, a solvent will usually be required to remove it.

There are three types of solvents in general use for this purpose. These are petroleum distillates, such as Stoddard Solvent or cleaners' naphtha, carbon tetrachloride, and a mixture of the two. The petroleum distillates are the solvents having the least corrosive action on insulation varnishes, and for that reason where conditions permit are preferable to the others. The Stoddard type solvent, produced by all the major oil companies, with a minimum flash point of 100 deg. F., minimizes the fire hazard, and should be used in preference to gasoline or benzene. Every precaution should be taken however, to prevent fires or explosions.

When this type of solvent will not properly clean the apparatus a mixture of carbon tetrachloride and the solvent may be used. A mixture of 50 per cent carbon tetrachloride and 50 per cent Stoddard Solvent is nonflammable, but the vapors mixed with a right proportion of air are explosive. In extreme cases it may be necessary to use straight carbon tetrachloride; however, its toxic effect on the operator must be taken into consideration.

Carbon tetrachloride is more corrosive in its action than petroleum solvents, and it evaporates much more rapidly. For this reason the residue of carbon tetrachloride should be removed by applying a petroleum solvent. This will prevent corrosion later on.

Before any solvent is used, be sure that there is good ventilation and minimum fire risk. Do not let the workers' clothing become saturated with the solvent. Always have fire extinguishers of the carbon tetrachloride type handy. If a hose is used to spray either cleaning solution or varnish, make sure that the nozzle is grounded.

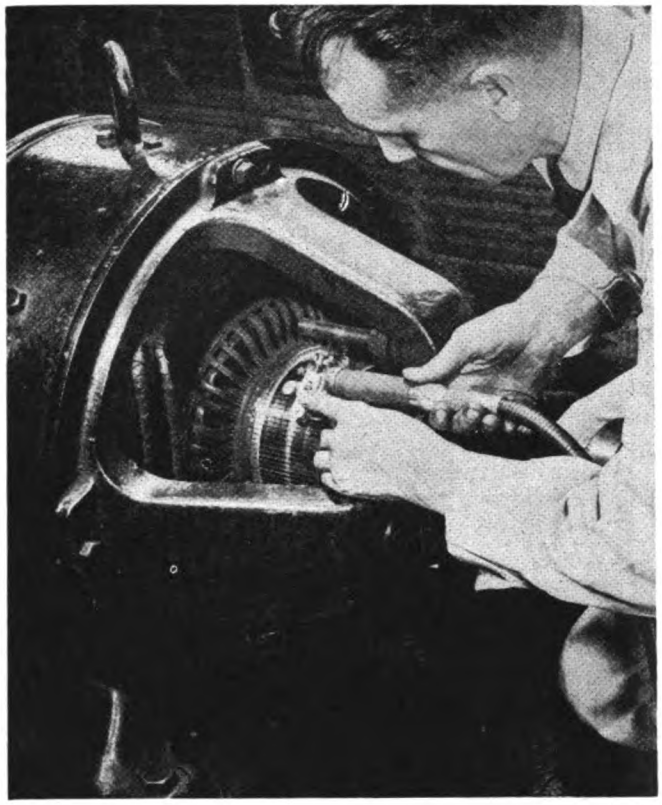


To keep a motor clean, use a suction hose or an air line—Although a metal cover (removed) gives some protection to this motor installed on a carpenter's saw, sawdust will get to the windings

Workmen should be guarded against breathing the fumes of carbon tetrachloride and they should be under the close observation of someone familiar with artificial respiration. Where conditions are particularly bad, such as in pits, gas masks should be worn.

The time to apply varnish treatment is after the motor has been thoroughly cleaned in solvent. Use a baking varnish recommended by the motor manufacturer for the particular conditions encountered. Two dips and bakes may be sufficient for normal conditions, while for extreme conditions of moisture and corrosive gases such as exist in roundhouses four dips and bakes may be justified. One or two additional coats of red synthetic enamel may be justified under extreme conditions.

Dry the motor in an oven before dipping in varnish. Electric or steam heat is the safest and most convenient.



To assure proper maintenance and prevent sparking, it is necessary to undercut the mica below the surface of the faster wearing copper commutator bars on a d.c. motor—This tool undercuts the mica to 1/16 in. below the commutator surface

Make sure that suitable temperature control is provided and that it is effective so as to prevent injury to the insulation. Maximum dry-out temperature is 155 deg. C. Baking temperature for the varnish and length of the baking period will depend on the type of varnish which is used.

Insulation Testing Determines Comparative Conditions

Insulation tests are made to determine the condition of the insulation rather than the quality of the insulation. While special conditions may justify dielectric tests, over potential tests, high frequency tests, or dielectric power factor tests, a test to determine the insulation resistance is generally all that is required in maintenance work.

The most convenient way to read insulation resistance is with a Megger. The 500-volt type is generally used. A higher-voltage Megger may damage low voltage insulation. Remember that the readings are valuable only from a comparative standpoint and that they vary greatly with the temperature of the apparatus. A safe general rule is that the insulation resistance should be approximately one megohm for each 1,000 volts of operating voltage, with one megohm as a minimum.

Totally Enclosed Motors Protected from Outside Air

Totally enclosed motors and totally enclosed fan-cooled motors have the frames sealed so as to exclude the outside air. They are well protected against the admission of abrasive dirt and metallic particles that shorten the life of insulation in open motors. For these enclosed motors there are two points which should be observed.

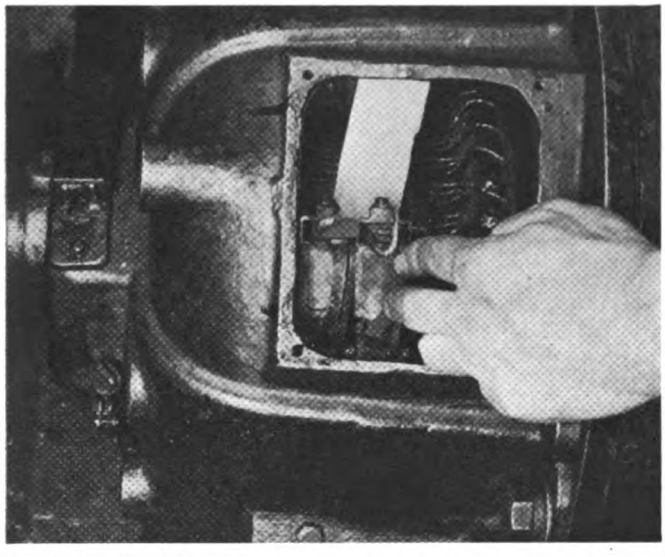
First, see that all exposed joints in the motor frame and brackets are tight. Use a water-resistant grease in the bracket fits, if the motor is dismantled for any reason. This will help to prevent accumulation of water in the bottom of the motor frame.

Second, make sure that the motor is provided with a drain plug or drain pipe at the bottom of the frame so that any accumulated water can be removed before causing trouble.

Careful Handling Required for Direct-Current Motor Repair

Direct-current motors add the commutator and its current-collecting details to the general maintenance problem. The armature is the heart of the direct-current motor. Through it flows the main-line current, and if the machine is overloaded the armature is the first to give evidence of distress.

When dismantling a d.c. motor for periodic overhauling the following points should be observed. Do not roll



A thorough maintenance program does not neglect brushes—Proper method of cleaning and surfacing is to press brush down on a strip of sandpaper placed between brush and commutator—Several passes should be sufficient, depending on brush condition—The sandpaper should be held flat against the commutator surface to prevent rounding of the brush end

the armature on the floor; a coil may be injured or the steel banding wire may be nicked. Support or lift the armature only by its shaft if possible. Never allow the weight of the armature to rest on the commutator or on the coils. Inspect the coils carefully to see that they are tight and where necessary replace the wedges. Replace any bands that may be loose.

As far as possible duplicate the banding originally furnished by the manufacturer. Do not change the material in the banding wire, the diameter of the banding wire, or the width or position of the band. Increasing the band width may cause heavy currents in the bands sufficient to overheat and melt the solder.

Only experienced workmen should tighten loose commutators. If the commutator bars are tight they will give out a clear bell-like ring when tapped lightly with a small hammer. If the commutator does not ring, but gives out a flat sound when struck, the front Vee should be tightened.

The exposed portion of the front mica V-ring is normally a catchall for oil and dirt. This section should be cleaned and protected with a layer of surgical tape and twine to prevent flashovers and breakdown to ground. Red synthetic enamel will give a smooth finish, resistant to oil and carbon dust.

Uniform Spring Tension on Brushes Prevents Selective Action

Check the brush rigging carefully. Most brush holders in use today are box type, and the brush holder should be replaced when the inside broached section is worn.

The brushes themselves must fit properly, not so tightly as to stick, and not so loosely as to shift position when running. Make sure that the grade used is correct for the application, using the advice of the manufacturer of the motor. Also make sure that the fit of the brush on the commutator extends across the face of the brush.

The spring tension on the brushes should be uniform so as to prevent selective action. The correct pressure will vary with the design of the machine and adjustments should follow the recommendation of the manufacturer. The brushes should be staggered in pairs of arms to prevent grooving of the commutator. Brush shunts should be kept tight and free from excessive corrosion so that current will be uniformly distributed to the brushes. Under bad conditions of corrosive atmosphere that are often found on railroads, the shunts can be protected by dipping in melted paraffin or in synthetic red enamel or by covering with woven cotton tubing.

Resurfacing of the commutator should be done in a lathe, or with a grinding rig. As it is impossible to obtain a true surface with a hand stone, it should be used only as an emergency. Practically all up-to-date direct current machines have undercut mica in the commutators. This undercutting should be kept $\frac{1}{16}$ in. deep.

Lubricating Oils for Gearmotors

A gearmotor is a self-contained drive made up of a ball-bearing motor and a speed-reducing gear unit. It is designed to take advantage of the electrical efficiency of the high-speed motor and the transmission efficiency of accurately cut and properly designed gears.

Suggestions already given apply to the motor element of the gearmotor unit. Front end motor bearings are generally grease-lubricated and require the same attention as in standard ball-bearing motors. Rear bearings, gear box bearings, and the gears themselves are almost always splash-lubricated from the same oil supply reservoir in the lower section of the gear unit. Oil seals at each bearing prevent oil leakage into the motor windings and out along the driving shaft. The precision cut gears demand carefully selected lubricating oils. Use only top grade oils of the viscosity called for by the manufacturer of the gearmotor. Observe particulars as to type of units and operating conditions.

See that the oil level marked for each gearmotor unit is maintained. For normal operating conditions, drain the oil reservoir in the lower section of the gear case once a year and refill with new oil.

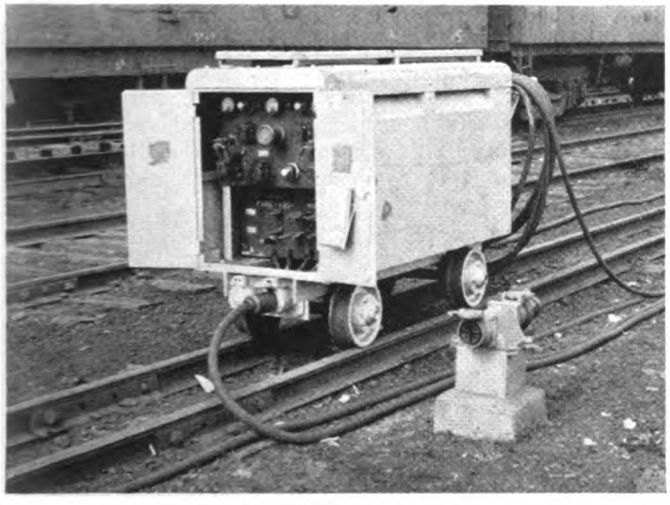
Charging Sets on Rails

War traffic proves capability of Jacksonville Terminal standby and charging power facilities

WHEN in 1934, the battery charging facilities in the yards of the Jacksonville Terminal Company became inadequate, a new system of power supply was installed which now under war traffic conditions has been able to prove its effectiveness.

The old charging facilities had become too small and were also unsuited to changing conditions . The yard had been enlarged so the charging outlets were no longer in the load center of the yard. Line loss was excessive because of the great length of low-voltage leads, and feeder maintenance presented a difficult problem because the yard is laid on a swampy soil which causes the tracks to work up and down under trains, damaging the conductors under the tracks. Small clearance between tracks makes an overhead system impracticable.

The estimated cost of installing a direct-current charging system of adequate capacity was $25,000. Under present conditions this would not have fulfilled all requirements because of the demand for 3-phase, 220-volt standby power.



One of the 200-amp., 50-volt Electric Products Company charging sets —Three-phase a.c. power is supplied to the sets through Albert & J. M. Anderson receptacles mounted on the concrete foundation in the foreground

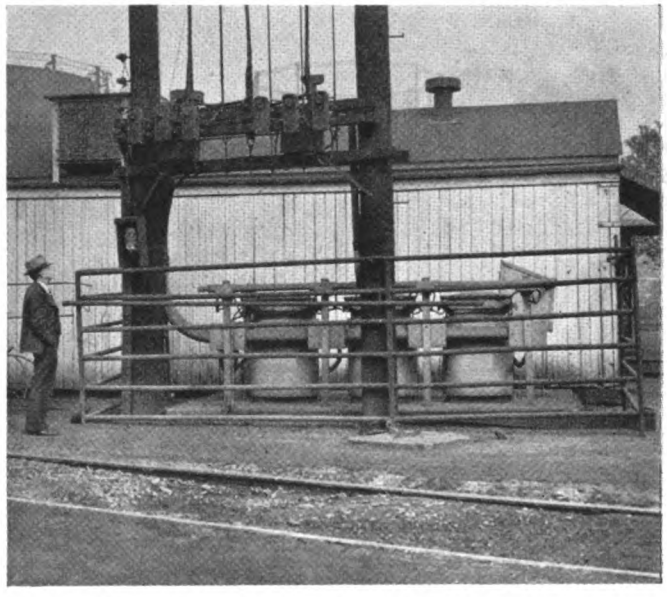
The system finally installed consists of a 3-phase, 220-volt distribution system, supplying cars directly with this kind of power, and portable 200- and 300-amp. motor-generators to supply d.c. charging current. The feature of the system which distinguishes it particularly is the fact that the sets are moved along the yard between cars on light narrow-gage track. One man can move a set easily, whereas ten men would have difficulty moving the same set along the soft cinder ballast.

There are four of the narrow-gage tracks, each about 650 ft. long. The gage is 18 in., the rail is 60- or 70-lb. rail and it is mounted on 24-in. lengths of standard ties spaced about 8 ft. apart.

Three-phase, 220-volt power is derived from a set of three 100-kva. transformers located at one side of the yard and this power is carried underground across the yard to the midpoint of each branch feeder cable which carries power along the narrow-gage, motor-generator tracks. The transformers also supply power for other requirements. The necessary current transformers, potential transformers and meter are located at the transformer station.

The main feeders consist of two 600-volt, three-conductor, 300,000-c.m. cables and the branches are 2/0. All underground cables are non-metallic and are laid in the ground without conduit. The three-phase, 220-volt outlets are spaced along the narrow-gage track 175 ft. apart; four to six on each track. They consist of Albert & J. M. Anderson, type F-4 duplex receptacles mounted on a concrete base. The feeders are brought up through a hole in the base which is filled with compound after the cables are brought in.

Connections between the outlets and the motor-generator sets are made with 100-ft. lengths of three-wire cable. This permits of placing the sets at any point on any of the four narrow-gage tracks. The same cables are used to supply standby power directly to cars equipped with a.c. motors.



The transformer bank which supplies the 220-volt power is self-contained, including disconnect fuses and metering equipment

The d.c. cables used to connect from the charging sets to the cars are 75 ft. long and consist of No. 2 Simplex 133-strand, Tirex cables, long enough to reach

four car tracks on either side of the narrow-gage track. When in use they are pushed under the rails when it is necessary to cross a track. The d.c. outlets on the sets are female receptacles while the d.c. cables have a male plug at one end and a female receptacle at the other, permitting the connecting of two or more cables together without the need for a separate connector. All plugs and receptacles were supplied by Albert & J. M. Anderson and are of 100-amp. capacity.

A total of 14 charging sets are used. Nine of these are 200-amp. 50-volt Electric Products Company machines, four are 300-amp., 50-volt E. P. machines and one is a Fairbanks-Morse machine which can be used to supply 90 amp. at 90 volts or 200 amp. at 50 volts. The latter machine is used for the charging of 64-volt cars and the 64-volt batteries of Diesel-electric locomotives. Some 110-volt cars also come into the yard, but these do not require charging. The 300-amp. charging sets have three outlet receptacles.

Control equipment on the sets is extremely simple. The generators are constant-current machines; no attempt is made to supply potential or modified potential control. The usual charging requirement consists of getting as much charge into the battery as possible in the limited time the car is available. Charging sets in service work at or near full load capacity.

There are three resistance control steps in each d.c.



D.c. charging cables from the sets on the narrow-gage track are pushed under the rails of adjacent tracks to reach cars on the other intermediate tracks

circuit and these allow for different current values in the two or three d.c. circuits to compensate for different sizes of batteries.

When one of two outlet circuits is disconnected, the voltage on the machine will rise. This causes a relay to operate which automatically disconnects the other circuit.

All machines are mounted on four 8-in. diameter, ball-bearing, flanged wheels. The two-circuit machines weigh about 1,800 lb.

Operation consists of checking the battery condition under full load when the car arrives at the station. If it is less than 28 volts, the battery is blue-tagged for charging.

The present system has about three times the capacity of the proposed new d.c. system which would have cost $25,000. The cost of the present system was less than $15,000. This increase in capacity is due in part to the flexibility of the system, the facility with which a car can be put on charge.

War conditions have increased charging requirements to about four times what they were before the system was installed and even the proposed d.c. system would



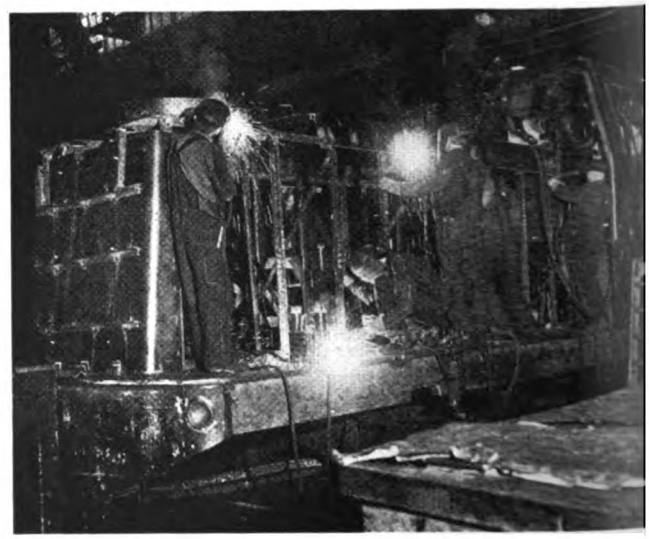
The Fairbanks-Morse 90-ampere set supplies power for 64-volt cars

now be inadequate; charging requirements are further increased by the use of old cars equipped with straight-storage systems and cars equipped with old types of axle lighting systems.

At present from 30 to 82 cars are charged every 24 hours.

The system was designed and its present method of operation developed by L. R. Andrews, electrical engineer, Jacksonville Terminal Company, Jacksonville, Fla.

* * *



A Diesel-electric switching locomotive frame being put together with electric welding at the Erie, Pa., works of the General Electric Company. When completed, the locomotive will be an 80-ton, 500-hp. switcher and will serve on an industrial railroad in a large steel plant

Life Insurance for V-Belts

Can you suggest ways and means of improving the performance and increasing the life of endless V-belt drives such as are used for railway passenger car air-conditioning compressors?

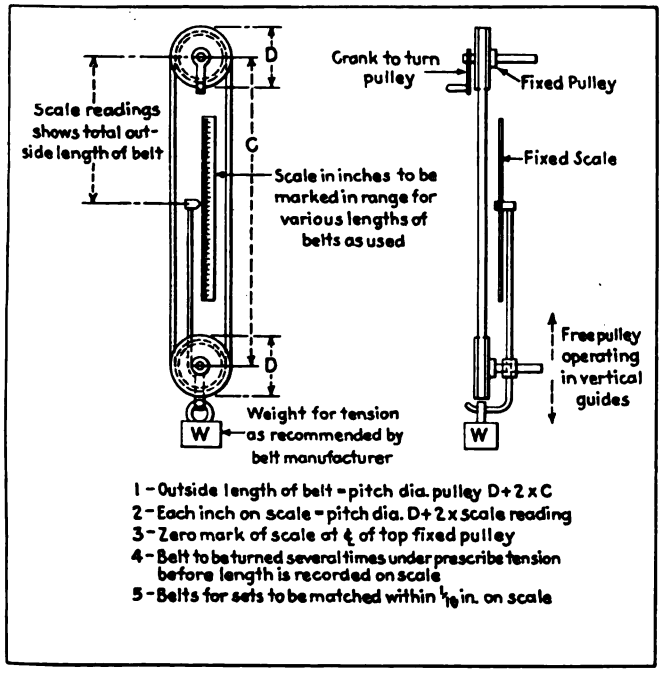
Use Only Matched Sets

Under present operating conditions, there is greater need than ever before for improving performance and increasing service life of V-type endless belts. Multiple V-belt drives for the conventional design of compressor drives usually consist of from five to seven belts. Certain application requirements must be met and adjustments made if these drives are to be efficient and have normal service life.

The first requirement of the multiple belt drive is equalized tension on all belts. Any difference in belt tension between the individual belts results in an overloading of the tight belts, which causes rapid wear and frequent failures.

The belts are usually furnished by the manufacturer in matched sets, but in application it is often necessary to break up matched sets, which results in stock of odd new belts. Failure of one or two belts of a matched set often requires the removal of the balance of belts which are in good serviceable condition. To provide the most efficient drive and increase service life, the use of a simple belt matching machine is recommended.

The attached print shows the basic elements of the device and recommended practice for operation. This machine may be constructed of second-hand or stock material. The arrangement as shown is for vertical setup, which allows the most simple design. The device may be mounted on a wall, thereby requiring little or no floor space.



Schematic arrangement for endless V-belt matching machine

The belts to be matched should be of same type and manufacture, and of same age and service life, since it is important that all belts of a matched set have the same physical characteristics to insure that each belt will carry an equal share of the driving load. The matched sets of reclaimed belts should be tied together and plainly marked for actual length and type of compressor application for which the length is used.

Extreme care and patience should be exercised in the application of belts. Many belts are ruined in application by forcing belts over pulleys without backing off the belt tension adjustment on the motor or compressor support. With the present scarcity of critical material as involved in belts, it is time well spent to make belt application in the proper manner.

The design and operation of the belt tension device is important for two major reasons; it must provide a suitable means for applying belts and it must maintain the proper tension to produce the most efficient drive and longest service life. Since the belts are subjected to a wide range in temperature and tension under normal operating conditions, the tension device should be frequently inspected and adjusted and, if possible to incorporate, the tension device should be equipped with a spring of sufficient capacity to hold belts at the recommended tension throughout their variation in length under load.

For the non-cooling period, the belts should be left on pulleys with tension reduced. At the start of cooling service, the tension on belts should be carefully inspected after first trial operation because belts shrink when not in service or under prescribed tension, thereby requiring tension adjustment until normal length is reached.

AIR-CONDITIONING ENGINEER

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York.

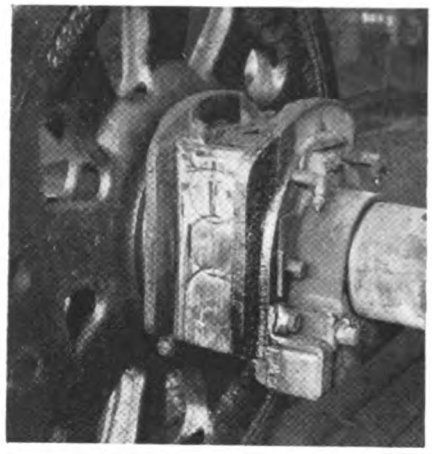
What suggestions can you offer for conserving the limited amount of Freon available for use in air-conditioned passenger cars?

The War Production Board is doing its utmost to locate every idle electric motor and generator and get it back into active service. To assist industry in locating the idle motors and generators, the General Industrial Equipment Division has set up a Used Motor Unit in its Electrical Equipment Branch. The unit has a file of about 30,000 used motors and generators including those listed by motor dealers with the OPA and those available in industrial plants. The Unit is under the direction of C. A. Sievert, former president of the National Industrial Service Association, who has had a long experience in the used motor field.

Lubricators For Driving Journals

Performance records are now available which indicate that the principles of mechanical lubrication of driving-wheel journals incorporated in the Hennessy mechanical journal lubricators are both satisfactory in service and economical in operation.

The outstanding feature of this driving



Driving box in which a Hennessy lubricator has been installed

journal lubricator is a submerged pump of sufficient capacity to furnish an oil bath to the journal at all times while the locomotive is in operation. The pump is actuated by the lateral movement of the locomotive with respect to the axle operating on contact rods. Special wipers, held against the journal on the hub end, permit ample oil to reach the hub faces. A similar wiper and extension on the end plate of the lubricator prevents loss of oil on the inside of the driving box. In case of failure of the pump, the lubricating distributor holds enough oil so that journal heating will be slow and warning given before extremely high temperatures are reached.

The lubricator displaces the conventional cellar. Application does not require change to either the driving box or the journal. The unit is completely self contained, no adjustments being necessary. Attention required consists of the usual inspection and replenishing of oil after each run and removal from the driving box for thorough inspection of all parts and cleaning at intervals of from three to six months, dependent upon the service of the locomotive. Usually this work is done when tires are turned. Valve oil is used during the summer months and heavy lubricating oil with a low pour test during the winter months or freezing weather.

On locomotives tested by the Pennsylvania at St. Louis, Mo., in 1904, where grease lubrication and oil lubrication were compared, friction losses on driving journals and crank pins were reported 75 to 100 per cent greater with grease than with oil. Friction horsepower in percentage of indicated horsepower ranged from 7 to 22 per cent with oil and from 15 to 27 per cent with grease.

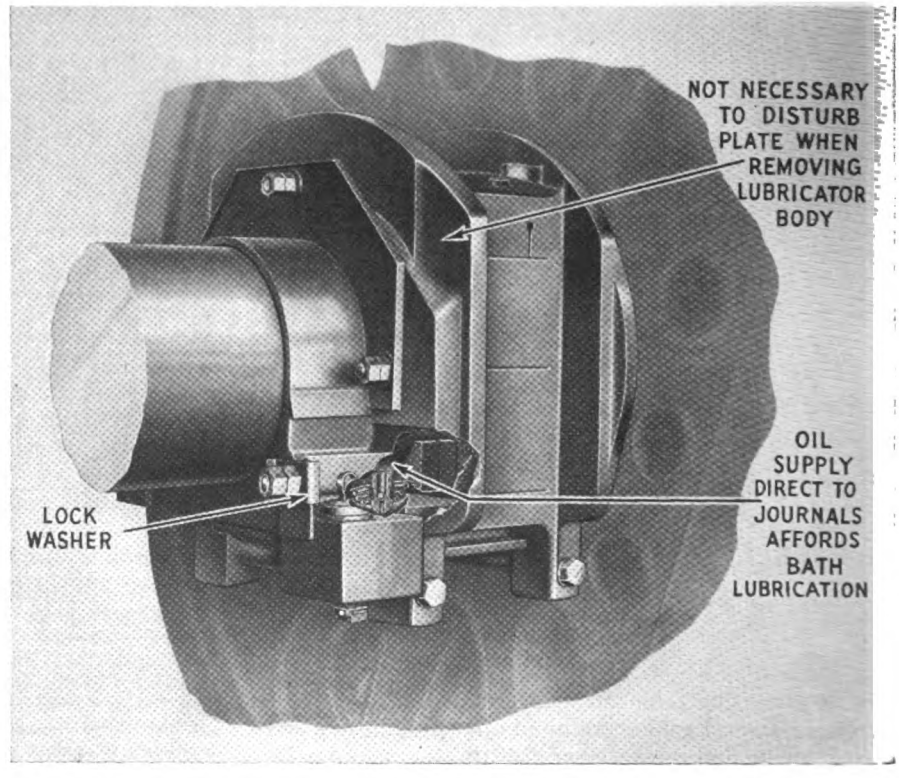
The conclusions from tests made at Purdue University in 1906 on an Atlantic type locomotive weighing 90,000 lb. on the drivers were stated in a report presented by Prof. W. F. M. Goss before the American Railway Master Mechanics' Association in 1908 as follows: "Accepting the oil lubrication as a basis of comparison, it appears that at 20 m.p.h. the loss of power resulting from the use of grease is slight, so small in fact as to be almost negligible, but as the speed is increased the loss is increased and at 60 m.p.h. it amounts to from 140 to 160 hp. The equivalent coal loss, assuming 4 lb. of coal per hp. hr., is something more than 500 lb. per hr."

Heavy journal loads, high speed and long runs have all increased the difficulty of lubricating driving journals with grease. As loads and speeds increased, the use of a harder grease became necessary. The higher melting point has caused the grease in contact with the journal to bake over or dry out, thus causing a further rise in temperature and increased wear both on bearings and journals, and increasing the development of heat checks in driving-axle journals.

A series of 12 4-6-6-4 locomotives on which Hennessy lubricators were initially installed and which operate in high-speed heavy-duty territory have accumulated more than 1,200,000 miles of service. With grease lubrication, experience on the road on which these locomotives are used indicates that the main bearings would have been taken down for renewal three times and would have had all journals out at least twice within that period of service. It is estimated that the saving in material and labor approximates $40,000. No trouble has been experienced with heating on any of the journals. During the month of December, 1942, the average oil consumption for each locomotive was 21.5 gals. in tender boxes, driving boxes, and trailer-truck boxes. This represented a lubrication cost of less than 50 cents per 1,000 locomotive miles for all driving journals.

A locomotive of the 4-8-2 type, one of six in high-speed passenger service, has made 265,000 miles and, although the tires have been turned, no crown bearings, with the exception of one renewed because it became loose, have been replaced or turned. On this same locomotive it has not yet been necessary to turn the journals.

A 4-6-2 type locomotive with driving journals equipped with Hennessy lubricators ran 100,166 miles with an average journal wear of 0.008 in. from the nominal diameter of the new journals. In the following 90,191 miles the wear from the time of the first measurement averaged 0.034 in. This represents a total average journal wear of 0.042 in. in almost 200,000 miles of passenger service. While this mileage was being accumulated, no work was re-



Driving box and cellar cut away to show the parts of the Hennessy lubricator

quired on the crown bearings and no journals were turned.

Electric locomotives of the 2-8-2 + 2-8-2 type which formerly used approximately 500 cakes of grease a year are now operating with lubricator-equipped drivers at an oil cost of less than 50 cents per thousand miles of service. In addition, these locomotives, which formerly required inspection at intervals of about eight hours, now require inspection only once in 36 hours. They are making about 25 per cent more mileage now than when lubricated with grease.

Hennessy lubricators have now been applied on 28 railroads to motive power used in all classes of service. The savings effected by oil lubrication of driving journals are in the cost of lubricant; reduction of labor expense associated with the provision and renewal of grease cakes and reconditioning of screens, and elimination of the necessity of inspecting driving boxes at intermediate terminals on long runs.

Emergency Lighting Unit

Requiring no fixtures or wiring other than plug-in connections to the a.c. supply, the Exide Lightguard emergency lighting unit



The unit goes into service automatically

for war-time service is announced by The Electric Storage Battery Company, Philadelphia, Pa. It throws a beam of light 50 ft. wide a distance of 150 to 200 ft., covering an area of 7,500 sq. ft.

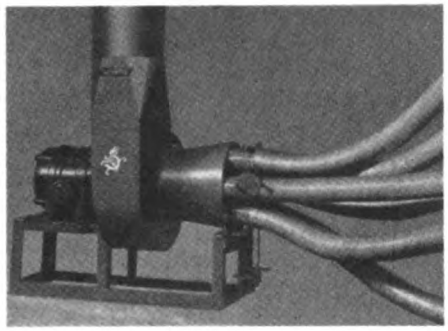
In the case of a power failure on the regular lighting system, the emergency unit is switched on automatically. The only maintenance required is the occasional adding of water. Recharging is done automatically by trickle charge. The state of the charge is clearly indicated by pilot balls.

Illumination is supplied by a sealed-glass type, prefocused auxiliary driving lamp (Mazda 4010) similar to those used on automobiles; a replacement can be obtained at most automobile accessory stores.

The unit is 16½ in. long by 6¼ in. wide by 18 in. high. The battery is a 3-cell Exide, type KZHGR-7 with thick plates assembled in a glass jar. It is a self-contained unit weighing 47 lb. and may be moved from its customary place to meet the needs of an emergency.

Ventilating Welding Operations

A fume exhauster, intended especially for use in connection with welding operations and which can be used on from one to six working stations, is being manufactured and distributed by the Chelsea Fan &



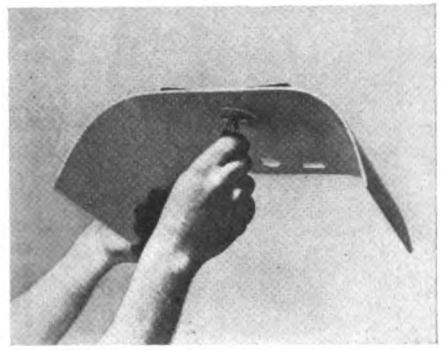
Six welding stations can be accommodated by this fume exhauster

Blower Company, Inc., Irvington, New Jersey. Known as the Octopus, this exhaust unit is so designed that fumes, gases, dust, filings and grinding compounds do not come in contact with the motor at any time while the unit is in operation. A 3-hp. motor is used to operate the blower wheel and the motor is tested to an 80 per cent overload. Six 3-in. hose connections can be operated from the unit and provide an exhaust of 245 c.f.m. of air when hose lengths are 100 ft. Using 10-ft. lengths of hose, the exhaust capacity is 400 c.f.m. The Octopus will accommodate four 4-in. hose connections if that arrangement is desired. Exhaust capacities then are 325 c.f.m. and 600 c.f.m. Reversing the position of the tube adapters converts the unit into a blower for ventilating purposes. A smaller model, the Octopus, Jr., will accommodate four 3-in. hose connections or three 4-in. outlets. Caps are provided to cover connections not in use.

Hanger for Fluorescent Lights

To save time in installing and cleaning its new line of composition reflector fluorescent fixtures, Sylvania Electric Products, Inc., Salem, Mass., announces the Captive Latch, a spring-type fastening that holds the reflector securely to the top housing.

The latch requires only a quarter turn to remove the reflector. No tools are needed and since the latch is an integral

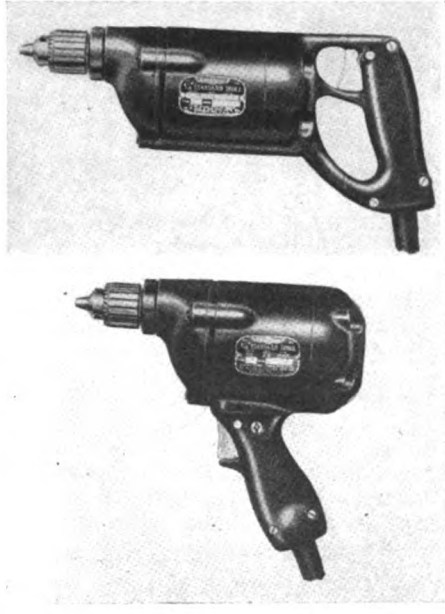


A quarter turn of the spring hanger locks the fixture in place

part of the top housing, it cannot become loose and drop out. The latch is inconspicuous in its position between the lamps and in no way affects the appearance or efficiency of the reflecting surface.

Hand Drills With Plastic Housings

Using a new plastic material called "Drillite", Black & Decker, Towson, Md., has designed practical housings for its ¼-in. standard drill and a ⅜-in. standard drill, which offer many advantages. Drillite plastic is made with a shredded cotton-duck base, which gives it a high impact resistance, and enables it to withstand considerable abuse and wear. The plastic is



Reduced weight of these drills with plastic housings gives a higher ratio of power per pound of tool weight

also heat resistant, and an insulator against dielectric shock. The housings are smooth and easy to handle.

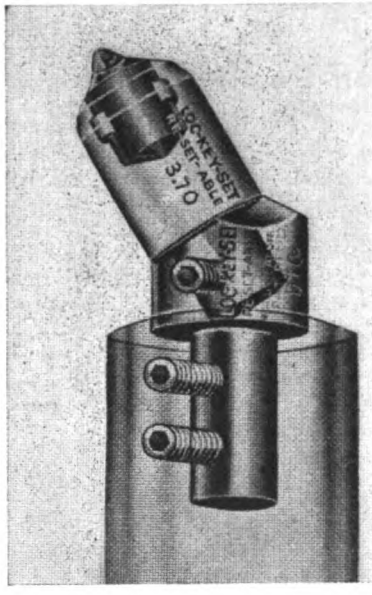
Steel inserts have been cast into the plastic housings to carry all ball bearings, and threaded steel inserts are cast in the field housing for housing assembly screws.

Steel air vents in the commutator-end housing insure ample motor ventilation.

There is a marked reduction in the weight of the complete unit as compared with former models using metal housings. The net result in the ¼-in. and ⅜-in. standard drills is a higher ratio of power per pound of tool weight. Both units are offered with either end-handle or side-handle control, equipped with a pistol grip and trigger switch; and with universal motors, operating on either alternating or direct current.

Angle-Set Diamond Holder

A 30-deg. side-angle lock-set holder which enables bullet-nose grinders, using centerless grinders with a templet attachment, to use common quality diamonds to form

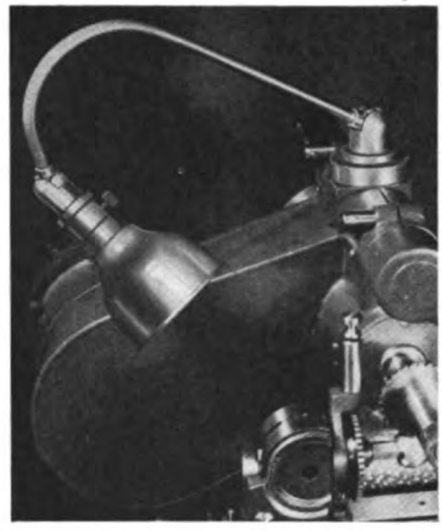


Angle-setting of this holder prevents wear in wheel dressing

grinding wheels by dressing from a one to six in. radius has been developed by the Diamond Tool Company, 938 East Forty-first st., Chicago. The mean fixed position left or right in which the diamond nib is held prevents wear to the setting in the dressing operation and eliminates the use of thin diamonds and weak points for dressing. Rotation of the nib presents a new sharp edge of the diamond to the wheel being dressed.

Local Lighting

For those lighting requirements which cannot be met satisfactorily by general illumination, the Reliance Devices Company, Inc., New York, is offering a line of adjustable lighting units known as Swivelier Work-Lites. Because of spring tension in the joints the units will not work loose or drop down. They are easy to adjust, requiring



A Work-Lite unit as applied to a milling machine

no wing nuts or set screws. The arm of the unit is adjustable through 90 deg. and the base may be rotated 350 deg. The socket may also be swung through a 90-deg. arc and rotated 350 deg. The arms are made in 6-, 12-, and 18-in. lengths and the reflector shades are made in three shapes—cone, bell and parabola. A stop prevents the twisting of wires and the unit is completely enclosed to protect it from oil and dirt.

Megger Insulation Tester

The James G. Biddle Company is now manufacturing in its Philadelphia factory the first U. S.-made Megger instruments for



Megger insulation tester in molded Bakelite case

testing electrical insulation resistance, and expects to be in full production about June 1 of this year. The new testers are of the hand-generator and direct-reading ohmmeter type and of the same general design as the Meg and Super-Meg insulation testers previously marketed by this company.

The cases are made of impact-resistant, thermo-setting phenolic molded material. The sections of the case fit together to form a unit that is dust-proof and practically splash-proof. The entire instrument, including the ohmmeter moving system, generator, driving gears, binding posts, etc., is built in Philadelphia directly from raw materials and fabricated parts. The manufacturer emphasizes the point that the instruments are not an assembly of "store parts" and that their construction does not depend upon the finished product of any other manufacturer.

Motor Speed Control

An a.c. electronic adjustable speed drive is announced by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. It consists essentially of a d.c. motor with separate electronic control of armature and field currents. By grid-control of rectifier tubes, the armature current may be adjusted from zero to maximum without

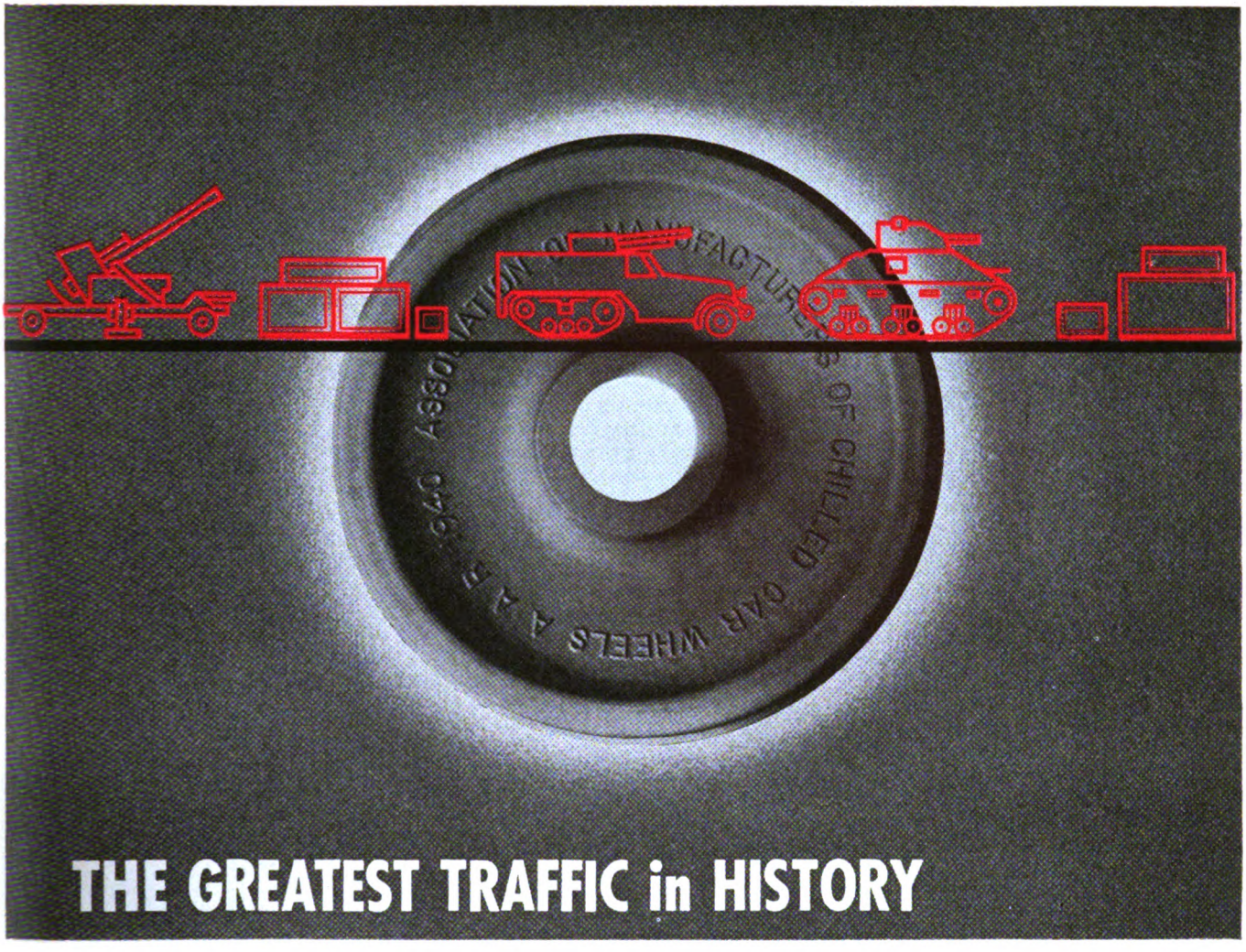


The adjustable speed drive consists of an electronic control cabinet, a push-button control station and a d.c. motor

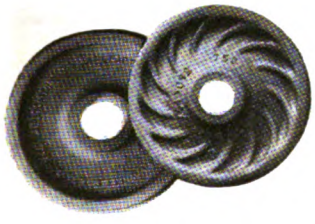
steps, while the field current is held at full value. Further increases of motor speed are obtained by reducing the field current. A current limiting feature prevents overspeed. Dynamic braking and extremely fast reversals may be obtained with black commutation. The drive provides constant torque for all speeds up to the base speed of the motor and constant horsepower above base speed. Small sizes of motors are operated from single-phase power and two- or three-phase power is used for larger sizes.

Speeds may be preset, within the design range. With two speed-control potentiometers and reversing contactors, different forward and reverse speeds may be preset

(*Continued on next left-hand page*)



ROLLED ON RAILROAD WHEELS!



In 1942 the railroads handled the largest volume of freight traffic in history, under the most difficult conditions. The first full year's operation under wartime restrictions has demonstrated again the ability of the railroads to do the "impossible"

Continuation of such severe operations will collect its toll in wear of equipment and trackwork. Even the most stringent maintenance program cannot prevent this wear. This will add to the already complicated problems of the railroads, as most of this equipment will be difficult to replace.

The wear on Chilled Car Wheels, which carried most of this record-breaking freight load, is not a serious problem because: Worn Chilled Car Wheels are quickly recast into new and better wheels with the use of very little additional metal. Thus Chilled Car Wheels will materially aid the railroads in handling the still greater loads expected during 1943.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW

3266

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

so that only the operation of the forward or reverse push buttons is necessary to obtain a predetermined speed in either direction. Speed adjustments may be made at any time while the motor is running.

Speed control is effected by potentiometers which change the firing point on the a.c. line voltage wave at which the tubes fire, varying the output d.c. voltage as required.

Filtered Incandescent Light

A line of incandescent lamps having pale green bulbs is being manufactured under the trade name Verd-A-ray by the Save Electric Corp., Toledo, Ohio. The colored glass filters out from 5 to 15 per cent of the light at the red end of the visible spectrum. The manufacturer states that since this increases the proportion of yellow-green light in the lamp output (that part of the spectrum to which the eye is most sensitive) the lamps provide a better color mixture for seeing and reducing glare. The light output is not cold, as might be anticipated, but is pleasing to most observers.

Locomotive Boiler Blow-Off Arrangement

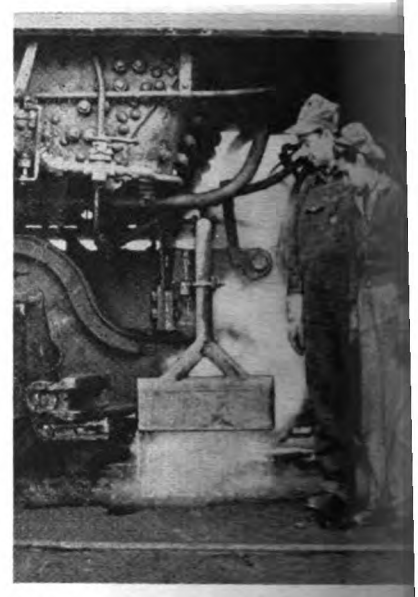
The road blowing of locomotive boilers has been a necessity for nearly 50 years. Previous to that time, it was possible to allow the concentration of dissolved salts and insoluble matter to accumulate until the boilers could be washed out. As pressures and corresponding boiler temperatures increased, dissolved and undissolved solids gave more and more trouble; and the wasting of concentrated waters from locomotive boilers became an absolute necessity with the advent of water treatment. In early experience with road blowing, the locomotive boiler blow-off cocks were blown openly, sometimes causing the destruction of ballast, damage to property, or injury to personnel.

In later years, with greatly extended locomotive runs, methods for disposing of the blow-off cock wastage on the road had to be revised. This led first to the use of baffling devices under the cab decks, but the complaints of roadway maintenance officers about the destruction of ballast multiplied rapidly, and these complaints were eventually supported by equipment-maintenance officers when under-body machinery began to show rapid deterioration, culminating when air-conditioning equipment generally commenced to be installed under car bodies.

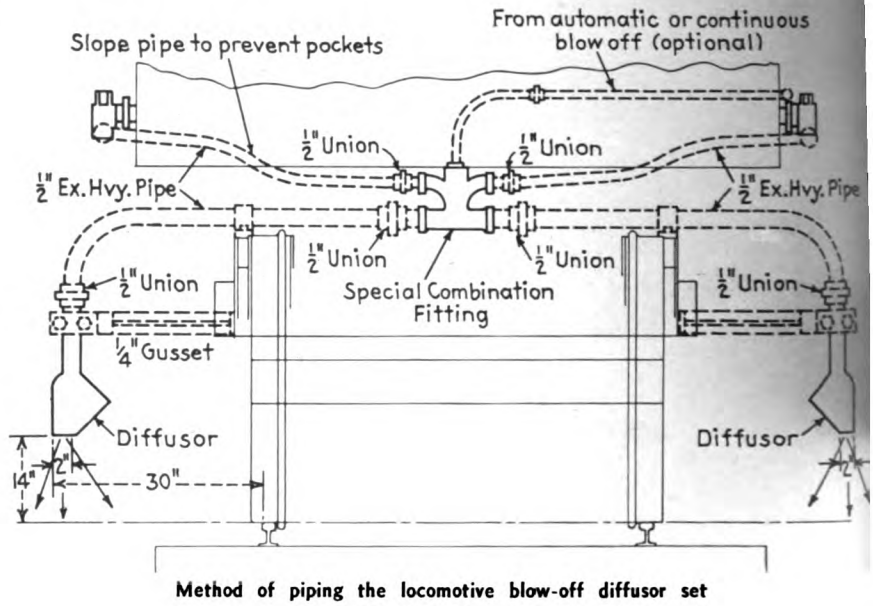
A radical improvement in the disposition of boiler blow-off cock wastage, developed by the Wilson Engineering Corporation, Chicago, was represented in a centrifugal muffler or separator mounted on top of the boiler. This device separated the steam flash from the solid water, delivering the former to the atmosphere and the latter by gravity alone to the tracks. It is widely used today, but has the disadvantage, in cold weather and in some districts, of permitting of the recondensation of a small proportion of the steam flash on the boiler jackets and cab windows. This has resulted in local complaints accordingly, although these complaints are not general, and are in small proportion to the large number in service.

A new type of equipment for the road blowing of locomotives, shown in the illustrations, has been developed on the Southern Pacific and is now being made and supplied to individual railroad requirements by the Wilson Engineering Corporation. This device, known as the Locomotive Blow-off Diffusor Set, returns to the earlier baffling principle, but with a wider spread than heretofore in diffusion of pressure and distribution of boile wastage to both sides of the locomotiv without damage to the ballast. A specia combination fitting, centered just ahea of the boiler throat sheet, is piped t receive the discharge from each blow-o cock, and from the continuous blow-o valve (if used), and to deliver this dis charge each way from the center to th Diffuser units on both sides of the loco motive. The discharge, again split at eac Diffuser unit and broken up by a narro horizontal bottom plate, or ledge, brought outside the tie ends and as low a clearances allow, in most cases about 14 i vertically and 30 in. laterally from the ra head.

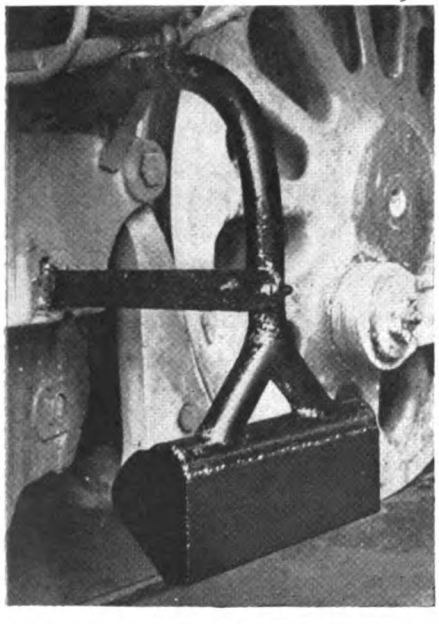
A large number of locomotives on th Southern Pacific Lines have been equipp with this device, and new locomotives no under construction by the Baldwin Loco motive Works and the Lima Locomotiv Works are specified to include this equi ment.



Wilson locomotive blow-off diffuser appli to a Southern Pacific locomotive

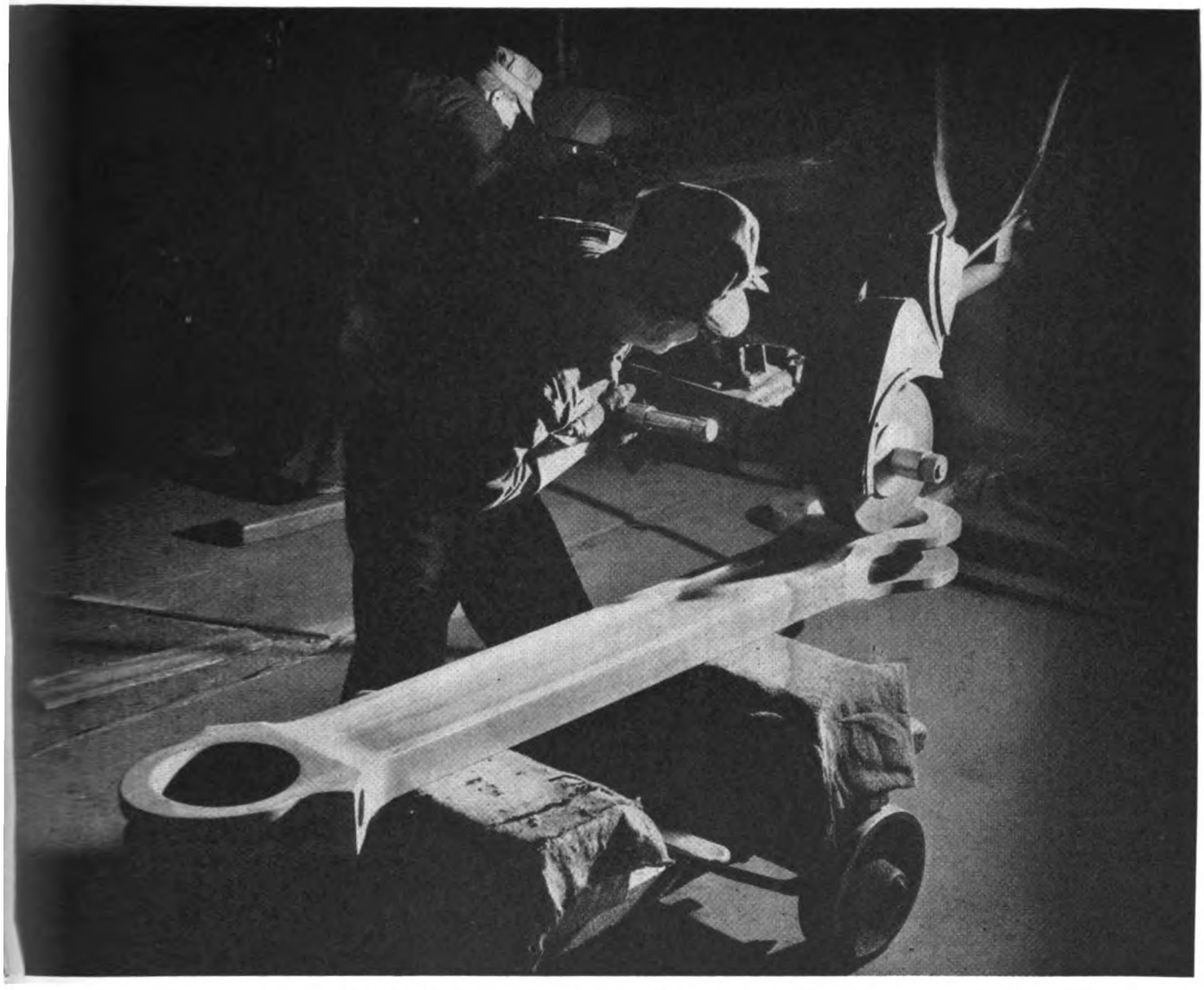


Method of piping the locomotive blow-off diffusor set



Diffuser on the right side of the locomotive—A similar unit is located on the left side

(Turn to next left-hand page)



Careful finish of the entire surface of Lima rods prevents formation of incipient cracks that might develop into full fledged flaws.

LIMA-BUILT POWER

. . . . IS DEPENDABLE POWER

The splendid record made by American railroads in motive power utilization during 1942 (87.8% in the peak month of October) is graphic evidence of the inherent quality and dependability of modern locomotives.

Dependability has been built into the Lima locomotives now serving many American railroads . . . dependability gained by specialized manufacturing methods, skilled craftsmanship and an experience stretching over three quarters of a century.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED INCORPORATED, LIMA, OHIO

High Spots in
Railway Affairs . . .

Women Employees On the Railroads

In mid-January of this year there were 63,187 women employees on Class I railroads. This was 4.79 per cent, or less than one-twentieth of the total number of employees—1,319,480. These figures are taken from the first of a new series of quarterly statistical statements to be issued by the Bureau of Transport Economics and Statistics of the Interstate Commerce Commission. The great bulk of these 63,187 women employees, or 48,138, were classed as professional, clerical and general. Of the 745 women employees in the maintenance of way and structures department, 375 were classed as extra gang workers and 260 as section workers. Of the 9,439 in the maintenance of equipment and stores departments, 3,263 were classed as coach cleaners; 2,629 as general laborers in shops, enginehouses and power plants; 1,386 as general laborers in stores and ice, reclamation and timber treating plants; 1,039 as skilled trades helpers in the maintenance of equipment and stores departments; and 1,005 as classified laborers in the shops, enginehouses and power plants. While 4,843 women were employed in the transportation department other than train, engine and yard, only four were classified under the head of transportation (train and engine). These were designated as road passenger brakemen and flagmen.

Engineering Pays Dividends

R. C. White, chief operating officer of the Missouri Pacific, in speaking before the Engineers' Club of St. Louis recently, commented upon the marvelous advances which have been made in railway efficiency and service since the first World War. He said he was "proud of the fact that engineering skill, engineering brains and engineering patience and perseverance, have been factors in making all this possible." At another point in his address he mentioned specifically some of the contributions that have been made by the engineers. These included the development of centralized traffic control; reduction in rail and mechanical failures through the use of electro-magnetic detectors; the equipping of locomotives with roller bearings, light alloy reciprocating parts, and superheated steam; the development of the Diesel locomotive; and the adaptation of the telephone, radio, teletype and photography as factors in increasing the over-all speed of cars from the point of origin to the point of destination.

Oil Movement Records To East Coast Broken

The movement of petroleum products into the East Coast area broke all records in the week ended April 3. The daily average tank car deliveries were 912,919 barrels, while 21,047 barrels a day came in drums loaded into box cars—a grand total of 933,966 barrels a day. This compares with the previous high record of 856,710 barrels a day during the week ended September 19, 1942. Meanwhile, construction of additional facilities for unloading tank cars at oil terminals is under way. It is expected by this means to increase the daily handling capacity by about 200,000 barrels. In all, there are 23 of these projects, extending from Norfolk, Va., to South Portland, Me., which will involve an expenditure of about one million dollars. The conversion of 100 steel gondolas, formerly cement carriers, is being completed to handle kerosene and fuel oil. They are being fitted with steel tanks for this purpose. Ten of the projected fifty Flexitank cars are nearing completion.

Travel Rationing Is Not Necessary

There have been widespread rumors to the effect that the Office of Defense Transportation would apply priorities to civilian train and bus travel. ODT Director Eastman declared on March 30 that these were "completely and entirely false." In further explanation Director Eastman said: "It is perfectly true that passenger transportation facilities are under severe strain. For this reason I have repeatedly urged, and I urge again, that people who have no real need to travel stay off trains and buses. If they will do so, the railroads and bus lines will be able to accommodate all the essential travel, and there will be no need to apply any compulsory restrictions. I still bellieve we can rely on the patriotic co-operation of the American people to avert any necessity for travel control by rationing or priorities."

Rail to Russia

According to Lend-Lease Administrator E. R. Stettinius, Jr., the lend-lease shipments from this country to Russia up to February 1, this year, have included a large amount of railroad material. Among them were 75,000 tons of rails and 17,000 tons of other equipment for the Soviet railways. A total of 580,000 tons of steel has also been shipped to Russia.

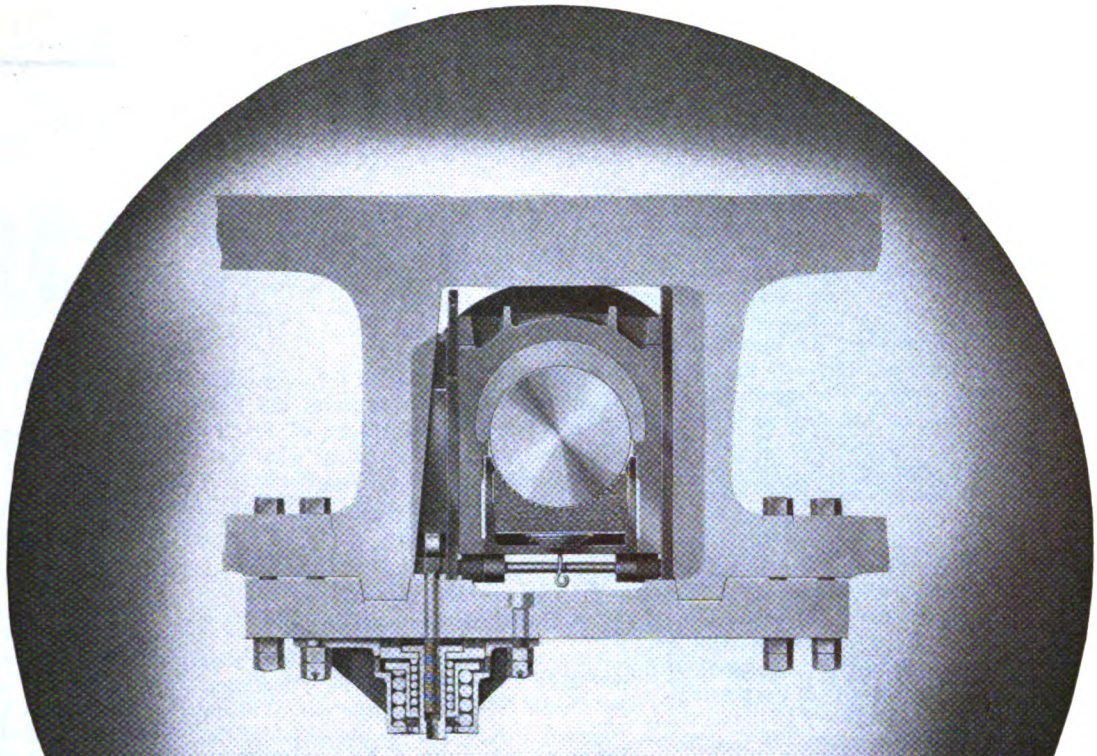
Rate Reductions

The Interstate Commerce Commission, by a close vote of six to five, has suspended the freight rate increases averaging 4.75 per cent, which became effective March 18, 1942. The increases in interstate standard passenger fares, which became effective February 10, 1942, were not disturbed, although the authority for the 10 per cent increase in interstate commutation fares, then granted, was revoked. Provision has been made, however, for independent hearings on these interstate commutation fares. Increases granted in rates on milk and cream, handled in either freight or passenger trains, were also suspended. Because of a tie vote between the commissioners, Mr. Eastman joined with them in making a decision, and thus cast the deciding vote. Joining with him were Commissioners Aitchison, Lee, Mahaffie, Splawn and Rogers. Separate dissenting opinions were filed by Chairman Alldredge and Commissioners Johnson, Miller, Patterson and Porter. The report indicated that the decision to suspend the freight rate increases was reached on April 6. It thus preceded the "hold-the-line" executive order of President Roosevelt on April 8, which, among other things, admonished federal and state regulatory authorities to disapprove rate increases and, if possible, effect rate reductions to keep down the cost of living and further the anti-inflationary purposes of the economic stabilization program.

Army Railroad Traffic

The Transportation Corps announced recently that during the first twelve months of the present war, the American railroads handled 41 million tons of army freight. This compared with 11,224,427 tons handled in the period from July, 1918, to June, 1919, which included the peak months of freight movement during World War I. The heaviest monthly movement of the last war was 1,445,535 tons, as compared to the largest monthly movement during the first year of the present war of 5,600,000 tons. During the first year of the present war the railroads handled 11,641,838 troops, about 60 per cent of which traveled on special trains. More than 55,000 open top cars for carrying equipment were included in the 21,000 special trains, the make-up of which also required 197,288 passenger cars and 79,443 baggage and freight cars. Cargo shipped to overseas troops now averages 82 lb. per man per day, as compared with 43 lb. in a comparable period for World War I.

(*Turn to next left-hand page*)



BEARING PROTECTION *for* *Overworked* LOCOMOTIVES

Locomotives were never worked harder than today. Never has it been more important to keep them on the road.

Thousands of locomotives are running longer between shoppings thanks to their Franklin Automatic Compensators and Snubbers.

This Franklin device compensates for driving box expansion due to temperature change and other operating conditions. It has ample reserve strength to take care of the high piston thrust of large locomotives and at the same time there is no chance for tight or stuck boxes.

By maintaining accurate driving box adjustment, the Franklin Automatic Compensator and Snubber increases locomotive mileage between shoppings and greatly prolongs the life of every bearing on the locomotive.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

NEWS

Freight-Car Conversions and Oil Movement

ONE hundred steel gondolas—former cement carriers—fitted with steel tanks in the shops of the Lehigh Valley at Packerton, Pa.; the Delaware, Lackawanna & Western at Scranton, Pa., and the New York Central at East Rochester, N. Y., will handle kerosene and fuel oil between Destrehan, La., and Chelsea, Mass., according to an announcement made by the Office of Defense Transportation on April 9.

The first 10 of a projected 50 "Flexitank" cars are expected to be in service shortly, the announcement added. These cars, which are automobile box cars fitted with canvas "balloons" processed with a rubber substitute, are being prepared at Aurora, Ill., by the Flexitank Corporation. Because of material shortages and costs the so-called Mareng cells will not be installed in box cars for commercial use at present, the ODT statement indicated, while experiments are still going on with the Baltimore & Ohio's plan to install corrugated steel tanks in automobile box cars.

Mechanical Committee, ODT, Meets in Chicago

MEANS of alleviating motive-power shortages, full utilization of cars and locomotives, and labor conditions were topics of discussion at the first annual meeting in Chicago on April 16 of the chairmen of the regional mechanical committees of the Office of Defense Transportation. Shannon Kuhn, deputy director in charge of locomotives of the ODT Division of Railway Transport, presided at the meeting, and C. J. Wolfe, associate director in charge of mechanical operations of the same division, spoke on the problem of keeping locomotives and cars in constant repair.

Reciting comparative statistics to show how the utilization of motive power has increased, and the number of locomotives and cars out of service for repairs has decreased, since 1940, Mr. Wolfe stressed his belief that the committee's most important task in the immediate future is to hold the line of current accomplishments in the face of increasing manpower problems. Wider employment of women and reduction of absenteeism through more intensive supervision were urged by Mr. Wolfe as means to overcome labor shortages.

Participating in this meeting was the recently established Chicago office, in charge of James E. Friend, deputy director. Mr. Friend, who had been deputy director in the Washington office, formerly was master mechanic of the Texas & Pacific at Fort Worth, Tex.

Other officers in the Chicago office are Albert V. James, locomotive assistant, and Frank J. Swanson, car assistant. Mr. James, transferred to the ODT from the War Department, was master mechanic of the Union Pacific, and Mr. Swanson, already on the ODT staff, was car department supervisor of the Chicago, Milwaukee, St. Paul & Pacific.

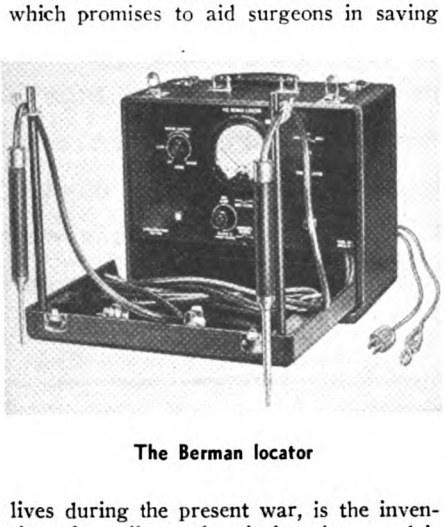
The Washington office of the mechanical operations section, which serves the East and the South, is in charge of Stanley Bliss Riley, deputy director, who was, until his retirement in 1939, general manager of the Pittsburgh & West Virginia.

"Silver Dollar Award" Combats Absenteeism

A SILVER dollar award for workers who have been 100 per cent on the job during the month has been adopted by William Sellers & Company, Inc., Philadelphia, Pa. The silver dollar, attached to a card which announces that the recipient is a member of the "Sellers 100 Per Cent Club," is placed in the regular pay envelope the first pay day of the succeeding month. The first presentation was made on March 12. A substantial cash award, in addition to the regular pay, is also to be given an employee who receives five silver dollars. Publicity is being given to the plan so that merchants and banks will not recirculate nor "make change" with the silver dollar. The employee or employee's family will thus enjoy the full significance of the award.

Waugh Builds Surgical Device for Armed Forces

THE Waugh Equipment Company is delivering its first orders for "Berman metal locators" to the medical services of the United States Army and the United States Navy. The development of this device, which promises to aid surgeons in saving lives during the present war, is the invention of a railway electrical engineer and is manufactured by a railway supply company. During 1939, while engaged in a series of tests for the New York Subway System, the engineers of the Waugh Equipment Company became interested in the work being done at that time by Samuel Berman, then electrical engineer of the subway, in the development of an electromagnetic means of locating metallic fragments buried in human flesh.



The Berman locator

This development had been encouraged by Dr. John J. Morehead, the medical director of the subway system, who had suggested to Mr. Berman that such a device would be useful in industrial hospitals. The first demonstration of the device was on one of the policemen injured in the New York World's Fair bomb explosion who continued to suffer pain after apparent recovery from his injury. The device located a small fragment deeply embedded in a tendon. Late in 1941 Dr. Morehead, on duty as an officer in the Medical Corps of the United States Army, was called to Hawaii to deliver a series of lectures in traumatic surgery. He had with him the first model of the locator which had its second practical demonstration immediately following the Pearl Harbor disaster where its effective use attracted wide attention. Following further refinements in the device, Mr. Berman joined the Waugh Equipment Company in December, 1942, and a plant has been equipped for the manufacture of the device, on orders from the federal government, and from a number of patriotic organizations for presentation to the armed services.

C. A. Gill Elected to Board of American Standards Assn.

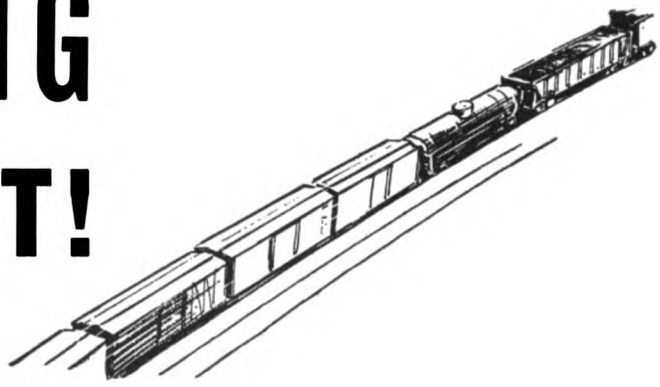
CHARLES A. GILL, vice-president in charge of operation and maintenance of the Reading, has been elected a member of the board of directors of the American Standards Association—a federation of national groups dealing with standardization—to serve a three-year term effective January 1, 1943.

Sleeping and Kitchen Cars for Troop Transportation

THE 1,200 troop sleeping cars and 400 kitchen cars, recently approved by the Association of American Railroads and the War department and endorsed by the Office of Defense Transportation, will be constructed and owned by the Defense Plant Corporation and will be operated in the Pullman Company's fleet of cars used in the transportation of troops. The 1,200 sleeping cars will replace day coaches now used in the transportation of armed forces and the 400 kitchen cars will release baggage cars now used as mess cars by the

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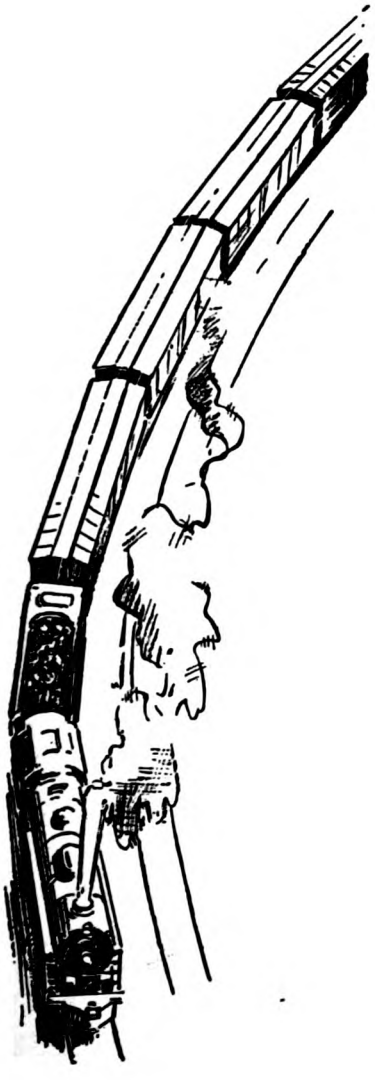
FUEL SAVING AN ARCH HABIT!

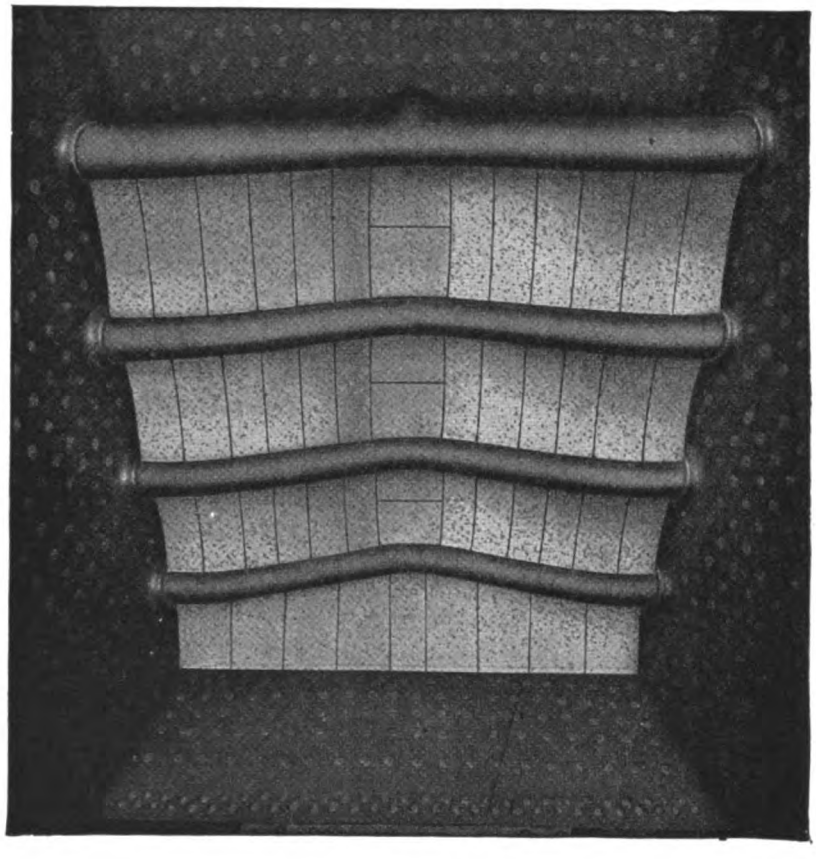


Over 32 years ago railroad men satisfied themselves as to the fuel saving of the locomotive Arch.

Since then the increase in locomotive power, higher rates of combustion and the widespread use of stokers has increased the fuel savings attributable to the Arch.

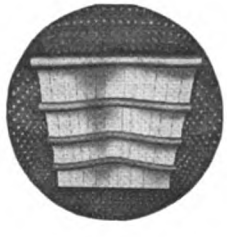
Today, when conservation of fuel is so vitally important to our war effort, don't handicap the effectiveness of the Arch by skimping on Arch brick. When your locomotives leave the roundhouse, be sure they are equipped with a *complete* Arch.





HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists



AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.
Locomotive Combustion Specialists

Army. At present each Army unit sets up its own mess equipment in baggage cars and prepares the food for its men. Under the proposed arrangement, each of the 400 cars will have Army personnel assigned to it permanently.

The new sleeping cars will depart slightly from standard sleeping car construction but will be interchangeable on all railroads and operable in passenger trains. They will have standard passenger-car trucks, underframes, couplers and brakes and standard passenger-car clearances. The width will be 9 ft. and the length 50½ ft. They will contain 30 beds arranged crosswise of the car in tiers of three and capable of accommodating one person each. The construction will be such that the lower and second berths can be lowered into position to serve as the seat and the back of daytime accommodations. The sides of the cars will be insulated and the cars will be equipped with windows, heat, light and toilet facilities. Whether air-conditioning equipment will be installed has not been decided.

The structure of the kitchen cars will be similar to that of the sleeping cars. Although no sleeping accommodations will be incorporated in the kitchen cars, they will be equipped with showers. These cars will also be fitted with iceboxes, cupboards and ranges. It is expected that the 1,600 cars will be completed at the rate of 15 a day, beginning July 1, by builders to be selected by the Defense Plant Corporation, a subsidiary of the Reconstruction Finance Corporation, when it and the War Production Board have approved the plan.

Equipment Depreciation Orders

EQUIPMENT depreciation rates for the Illinois Central, Grand Trunk Western, and the Colorado & Southeastern have been prescribed by the Interstate Commerce Commission in new sub-orders and modifications of previous sub-orders in the general proceeding involving depreciation rates for equipment of steam railroad companies.

Rates for the I. C. are: Steam locomotives, 3.18 per cent; Diesel passenger locomotives, 6 per cent; Diesel switching locomotives, 3.92 per cent; freight-train cars, 4.1 per cent; articulated streamline passenger-train cars, 6.97 per cent; non-articulated streamline passenger-train cars, 3.84 per cent; Diesel rail motor cars, 15.76 per cent; all other passenger-train cars, 2.97 per cent; floating equipment, 3.26 per cent; work equipment, 3.26 per cent; miscellaneous equipment, 14.49 per cent. For the Grand Trunk Western, the following rates are prescribed: Steam locomotives—owned, 3.27 per cent, leased, 2.77 per cent; other locomotives—owned, 3.93 per cent, leased, 3.92 per cent; freight-train cars—owned, 3.3 per cent, leased, 3.03 per cent; passenger-train cars—owned, 4.46 per cent, leased, 2.83 per cent; work equipment, 3.67 per cent; miscellaneous equipment, 9.73 per cent.

Supply Trade Notes

BALDWIN LOCOMOTIVE WORKS.—*Charles E. Brinley*, president of the Baldwin Locomotive Works, has been elected to the newly created position of chairman of the board, and *Ralph Kelly*, executive vice-president, has been elected president. Mr. Brinley will remain chief executive officer and will continue general supervision and direction of the affairs of the company and Mr. Kelly will retain his responsibilities as principal operating officer and will be in charge of the active management of the company's various divisions and wholly-owned subsidiaries. *William H. Harman* has been reelected vice-president in charge of sales. *Frank K. Metzger* of the Standard Steel Works division; *Norris H. Schwenk* of the Cramp Brass and Iron Foundries division; and *Frederick G. Schranz* of the Baldwin Southwark division have been reelected divisional vice-presidents. *Lewis W. Metzger* has been elected divisional vice-president of the Locomotive and Ordnance division to succeed Haldwell S. Colby, resigned, and *W. Horace Holcomb*, formerly assistant to the executive vice-president, has been appointed assistant to the president.



Ralph Kelly



C. E. Brinley

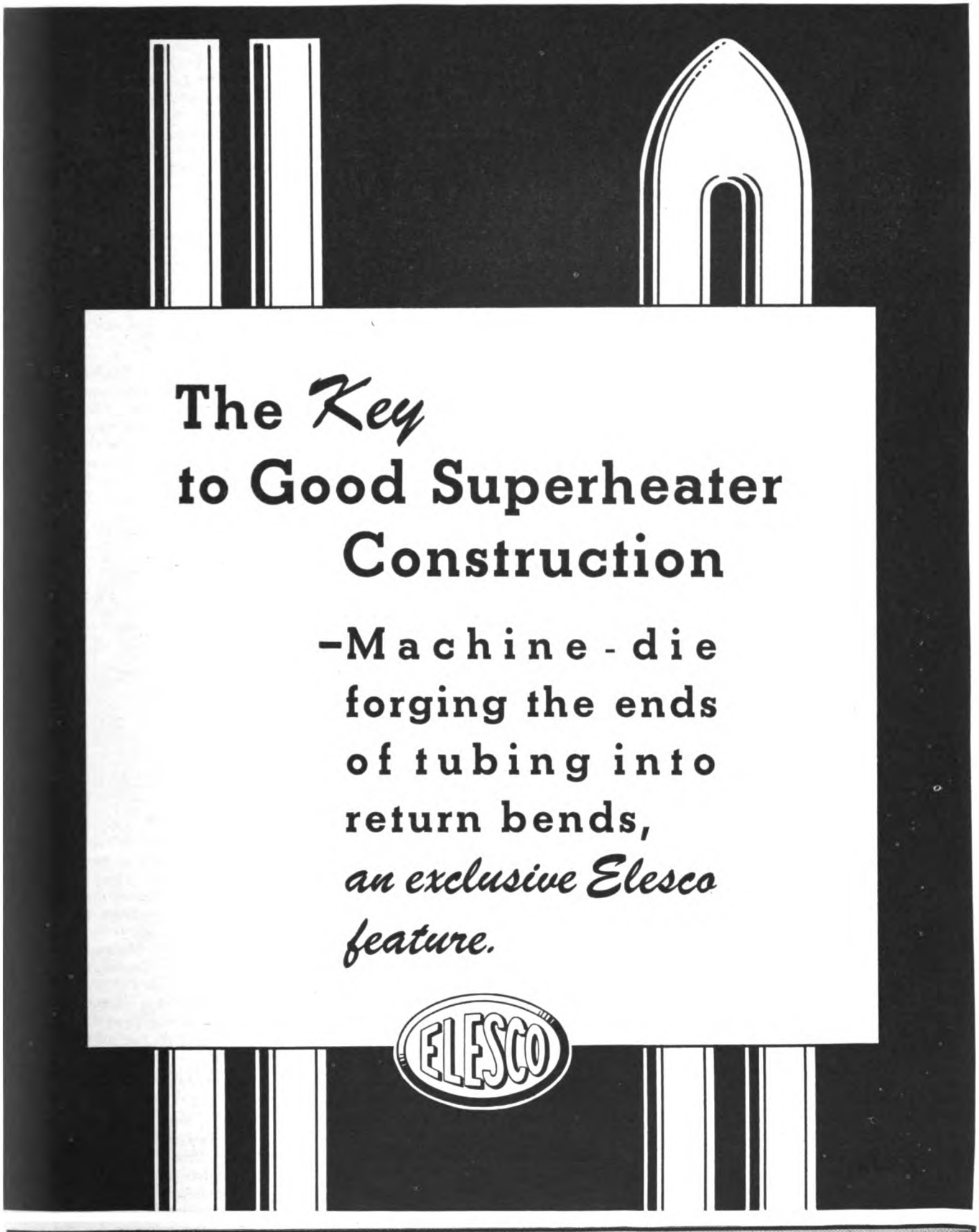
Charles E. Brinley was elected to the presidency of the Baldwin Locomotive Works in December, 1938. Earlier in that year, when the company was reorganized under the Federal Bankruptcy Act, he had been elected a director and member of the executive committee. For a short period following the resignation of G. H. Houston, when the presidency of the company was vacant, he served as acting vice-president with full executive powers. Mr. Brinley was born in Philadelphia on February 25, 1878, and received his higher education in mechanical engineering at Yale University, obtaining his bachelor's degree in 1900 and a degree from the Sheffield Scientific School in 1901. Since 1901 and prior to his association with Baldwin he had been with the American Pulley Company of Philadelphia, Pa. He became president of that company, a concern founded by his father, in 1919. Mr. Brinley is a member of the American Society of Mechanical Engineers, a director of a number of industrial, public utility and insurance companies and a trustee of the Drexel Institute of Technology.

Ralph Kelly was graduated from Harvard University in 1909 and, in the same year, became associated with the Westinghouse Electric & Manufacturing Company as an apprentice in its power engineering department. He served as a lieutenant in the United States Navy during the first World War and in 1920 rejoined the marine engineering department of Westinghouse, subsequently becoming the engineering manager of the company's southwestern district, with headquarters at St. Louis, Mo. He was appointed manager of the



Lewis W. Metzger

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SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

THE SUPERHEATER COMPANY

Representative of
AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
122 S. Michigan Blvd., CHICAGO
• • •
Montreal, Canada
THE SUPERHEATER COMPANY, LTD.

district and later manager of the central district at Pittsburgh, Pa. In 1934 Mr. Kelly was named vice-president in charge of the operating division of Westinghouse and, in 1938, became vice-president in charge of sales. He left Westinghouse in March, 1942, to become executive vice-president and a director of the Baldwin Locomotive Works.

◆

GENERAL STEEL CASTINGS CORPORATION.—*Charles P. Whitehead,* vice-president of sales of the General Steel Castings Corporation, with headquarters at Eddystone, Pa., has had his jurisdiction extended over the manufacturing and engineering departments. *P. R. Keller,* has been appointed manager of miscellaneous sales with headquarters at Eddystone.

◆

MAGNUS CHEMICAL COMPANY, INC.—*J. D. Holmes* has been appointed manager of the newly organized Feedwater Treating division of the Magnus Chemical Company, Inc., Garwood, N. J.

◆

GLOBE STEEL TUBES COMPANY.—*C. J. Bickler,* sales manager of the Cleveland, Ohio, district of the Globe Steel Tubes Company, Milwaukee, Wis., has been appointed assistant to the vice-president in charge of sales, with headquarters at Milwaukee.

◆

AMERICAN STEEL & WIRE COMPANY.—*H. F. Clarke,* assistant superintendent, has been appointed director of spring mill products of the American Steel & Wire Co., a subsidiary of the United States Steel Corporation, to succeed *Leonard C. Peskin,* who has resigned.

◆

H. K. PORTER COMPANY, INC.—*Roy B. Rose,* an executive of the H. K. Porter Company, Inc., Pittsburgh, Pa., has been appointed manager of a new district office for eastern Pennsylvania, western New Jersey, Maryland and Delaware, opened in the Girard Trust Building, Philadelphia, Pa. The Porter Company has been authorized by the Defense Plant Corporation to provide equipment for a plant in Pennsylvania at an approximate cost of $100,000. The new facilities will be operated by the Porter Company, with title remaining with the DPC.

◆

GREENE, TWEED & CO.—*J. J. McIntosh* has been appointed southeastern sales representative and *B. F. Coombs,* Texas sales representative of Greene, Tweed & Co., New York. The headquarters of Mr. McIntosh are at 1106 McLynn avenue, Atlanta, Ga. Mr. Coombs address is Route 12, Box 495, Houston, Tex.

◆

CRANE COMPANY.—*Harry F. Potter,* who has been associated with the Crane Company for 43 years in the finance, credit, operating and sales departments and has been manager of branch houses since 1931, has been elected secretary of the company. *James A. Dwyer,* district manager with headquarters at New York, will succeed Mr. Potter as manager of branch houses. *David J. Molloy,* assistant manager of the New York branch, will succeed Mr. Dwyer as district manager, and *George P. Gregory, Jr.,* has been appointed assistant manager.

◆

SKF INDUSTRIES, INC.—*Thomas W. Dinlocker* has been elected vice-president and treasurer; *Richard H. Demott,* vice-president in charge of sales, and *C. P. Collins,* secretary of SKF Industries, Inc., Philadelphia, Pa.

◆

LIMA LOCOMOTIVE WORKS, INC.—*D. S. Ellis,* until May 1 chief mechanical officer of the Chesapeake & Ohio, the New York, Chicago & St. Louis and the Pere Marquette, has become vice-president in charge of manufacture of the Lima Locomotive Works, Inc., with headquarters at Lima, Ohio. Mr. Ellis was born at Warwick, N. Y., on January 25, 1897, and attended the Warwick High School. In 1916 he became a clerk in the auditor's office of the Lehigh & Hudson River and in 1917 a clerk in the office of the auditor of freight accounts in the New York Central. During a period from 1917 to 1918 he served as a machinist and as acting enginehouse foreman. In 1918 he became a draftsman, serving in this position and as an engineer,



D. S. Ellis

calculator, designer and traveling engineer until 1924. In that year Mr. Ellis was appointed assistant engineer of motive power, New York Central Lines. On May 1, 1929, he left the employ of the New York Central and accepted the position of eastern district manager and, subsequently, manager of the Railroad Division of the Worthington Pump & Machinery Corporation. On October 1, 1932, he resigned to become engineer of motive power on the Advisory Mechanical Committee of the Chesapeake & Ohio; Erie; New York, Chicago & St. Louis, and Pere Marquette, with headquarters at Cleveland, Ohio. In January, 1936, Mr. Ellis was appointed mechanical assistant to the vice-president of the C. & O.; N. Y. C. & St. L., and P. M., and in July, 1936, chief mechanical officer.

◆

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—*Thomas T. Bakke,* formerly with the Westinghouse engineering and service department in Milwaukee, Wis., has been appointed manager of the Milwaukee branch of the company's manufacturing and repair division.

◆

PATTERSON-SARGENT COMPANY.—*Ben G. Bowman,* a railway salesman of the Patterson-Sargent Company, Cleveland, Ohio, has been appointed manager of railway sales, in charge of all divisions except New York and Boston. Previous to entering the employ of the Patterson-Sargent Company, Mr. Bowman was employed in various departments of the New York, Chicago & St. Louis and as a freight representative of the Northern Pacific in Cleveland.

◆

INDEPENDENT PNEUMATIC TOOL COMPANY.—*Neil C. Hurley, Jr.,* for the past four years vice-president and director of the Independent Pneumatic Tool Company, Chicago, has been elected executive vice-president. *John A. McGuire,* formerly manager of the accessories department, has been elected secretary, and *E. R. Wyler,* formerly manager of the New York sales office, has been appointed vice-president. Mr. Wyler and Mr. McGuire will have their headquarters in the company's New York offices.

◆

DETROIT LUBRICATOR COMPANY.—*E. J. Doucet,* sales assistant to the president of the Detroit Lubricator Company, has been appointed general sales manager. Mr. Doucet has been associated with the company for the past 26 years. Until two years ago he was in charge of oil-burner equipment sales for the western territory with headquarters at the company's Chicago office. He was subsequently transferred to the main office at Detroit, Mich., as sales manager in the oil-burner equipment division, and then appointed sales assistant to the president.

◆

COPPERWELD STEEL COMPANY.—*Harry A. Billica,* formerly senior industrial specialist in the War Production Board's office of war utilities, has joined the sales organization of the Copperweld Steel Company. Before his association with the WPB, Mr. Billica was sales engineer for the Indiana Steel & Wire Co., and prior thereto he was associated with the Graybar Electric Company as Pacific district line material manager. *M. A. Williams* has been appointed district sales manager in charge of the new Indianapolis, Ind., sales office. Mr. Williams' territory will include central and southern Indiana, southwestern Ohio and the state of Kentucky.

Army-Navy E Awards

American Car and Foundry Company shipyard. Second renewal.

Johns-Manville, Manville, N. J. March 24.

National Machinery Company, Tiffin, Ohio. March 18.

Pittsburgh Steel Company, Allenport, Pa., and Monessen. March 18.

Whiting Corporation, Harvey, Ill. April 20.

NATIONAL TUBE COMPANY; TUBULAR ALLOY STEEL CORPORATION.—*Charles R. Cox*, executive vice-president of the National Tube Company, has been elected president of this company and the Tubular Alloy Steel Corporation, two subsidiaries of the United States Steel Corporation, to succeed *Benjamin F. Harris*, who has resigned and is now a consultant to the president of the corporation in connection with war activities.

◆

KERITE INSULATED WIRE & CABLE COMPANY.—*C. R. R. Harris* has been elected president of the Kerite Insulated Wire & Cable Company to succeed *Richard D. Brixey*, deceased. Mr. Harris is a native of Randolph county, Indiana. After completing high school and a two-year electrical course, he entered the employ of the Western Electric Company in 1905. In 1910 he joined the engineering staff of the Western Union Telegraph Company where he was engaged for about seven years in plant engineering. In 1917 he joined the Kerite Insulated Wire & Cable Co. in



C. R. R. Harris

charge of engineering. From that date until 1927, when he became vice-president and general manager of the corporation, he was associated with the design and development of Kerite cable for use in many special services in the electric power field. Mr. Harris has been a member of the American Institute of Electrical Engineers for 38 years.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION.—*Dr. Edgar C. Bain*, since 1938 assistant to the vice-president in charge of research and technology for the United States Steel Corporation of Delaware, has been appointed vice-president in charge of research and technology, for the Carnegie-Illinois Steel Corporation, United States Steel subsidiary.

◆

FAIRBANKS-MORSE & CO.—*Charles H. Morse, Jr., Charles H. Morse, III*, and *Robert H. Morse, Jr.*, have been elected directors of Fairbanks-Morse & Co., Chicago. In addition, Robert H. Morse, Jr., assistant sales manager, has been promoted to general sales manager, with headquarters as before at Chicago.

Robert H. Morse, Jr., general sales manager, entered Fairbanks-Morse service in 1916. He enlisted in the U. S. Army in 1917, saw considerable service in France and after the conclusion of the First World War, returned to Fairbanks-Morse, where



Robert H. Morse, Jr.

he spent 10 years in the manufacturing divisions of the company. He then served successively as manager of the branch sales offices at Cincinnati, Ohio, Dallas, Tex., and Boston, Mass., and as manager of sales for the Stoker division. In August, 1942, he was appointed assistant sales manager at Chicago.

◆

ALLEGHENY LUDLUM STEEL CORPORATION.—The Allegheny Ludlum Steel Corporation, Brackenridge, Pa., has transferred its tool steel sales headquarters from Pittsburgh, Pa., to Dunkirk, N. Y., in order to centralize both sales and manufacturing supervision of tool steels at Dunkirk.

Obituary

CHARLES WILLIAM WERST, chief inspector of the Baldwin Locomotive Works, died at the age of 75 years, in West Palm Beach, Fla. Mr. Werst entered the employ of the Baldwin Locomotive Works in 1898. He served as foreman and superintendent of a number of shops until 1910, when he left to become general superintendent of the Lima Locomotive Works, returning to Baldwin in 1915. In World War I he headed a group of engineers and mechanics who went to Russia to assemble Baldwin locomotives.

◆

RICHARD DEWOLFE BRIXEY, president and treasurer of the Kerite Insulated Wire & Cable Co., Inc., New York, died on March 14. He was 63 years of age. Mr. Brixey was born in Seymour, Conn., in 1880. Following his graduation from the Sheffield Scientific School at Yale University in 1902, he immediately began work in the Seymour plant of the company, which was owned by his father, W. R. Brixey. He worked his way through all the processes of manufacturing and was particularly interested in the later developments of Kerite for railroad signal service, a pioneer operation of the Seymour plant. He came to the New York office of the company as general manager in 1910 and reorganized the business in 1912 under its present corporate name, the Kerite Insulated Wire & Cable Co., Inc., of which he became president and treasurer. Mr. Brixey was a member of the signal section and the telephone and telegraph section of the Association of American Railroads; a member of the Association of Railway



Richard DeWolfe Brixey

Electrical Engineers; the Railway Business Association; the American Institute of Electrical Engineers; the American Society for Testing Materials; the rubber division of the American Chemical Society; the National Electrical Manufacturers Association; and the Railroad-Machinery Club.

◆

JOHN W. FOGG, vice-president and general manager of sales of the MacLean-Fogg Lock Nut Company, Chicago, died on March 5. Mr. Fogg was born in England and at an early age moved to Canada where he received his education. He entered the service of the Grand Trunk Western and served his apprenticeship at

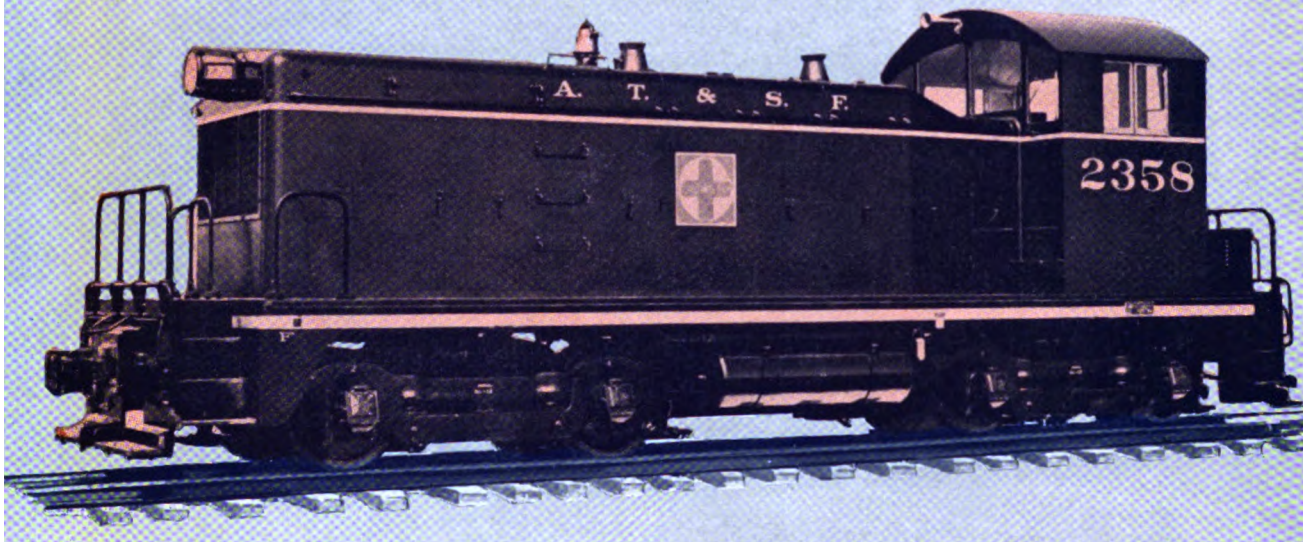


J. W. Fogg

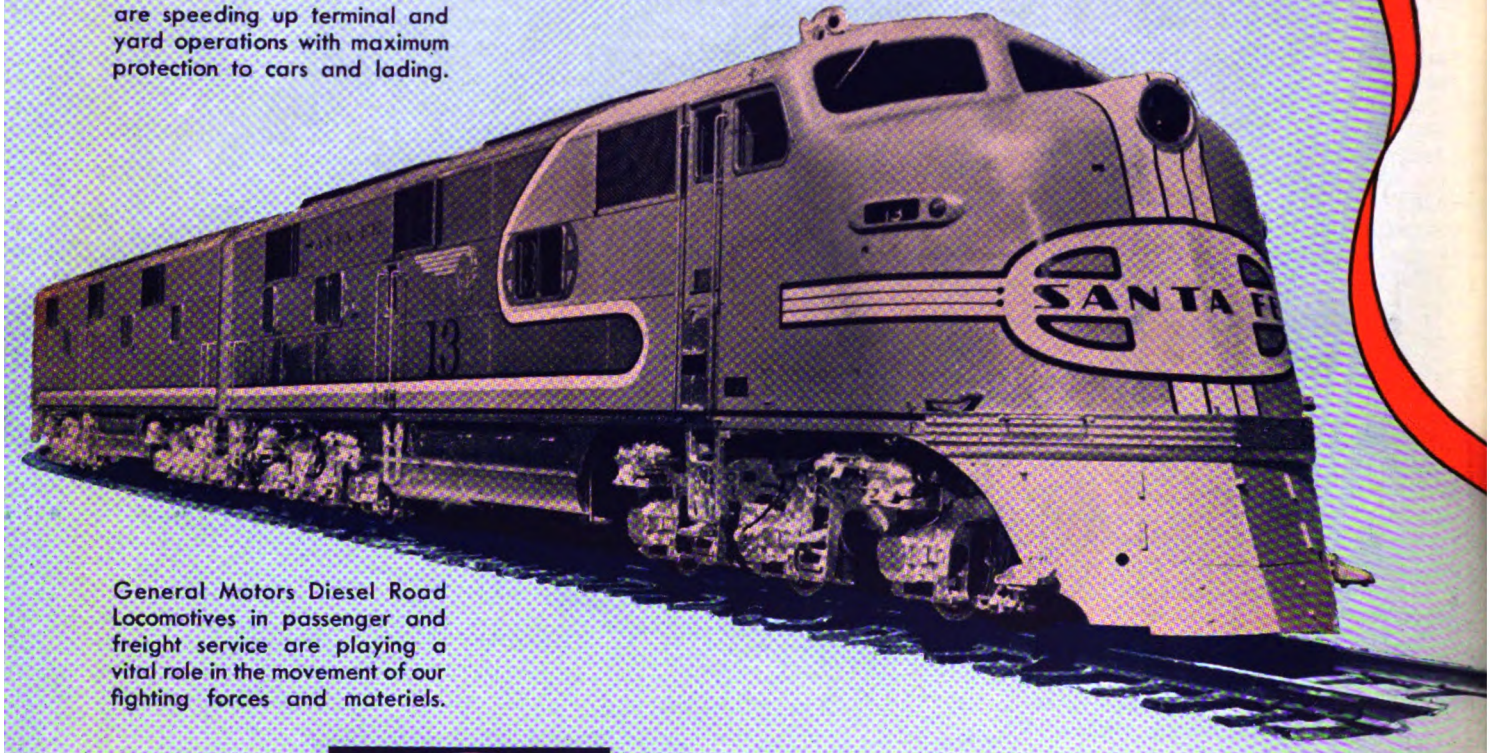
Hamilton, Ont. Later he came to the United States and worked as a locomotive engineer on the Wisconsin Central and then on the Chicago Terminal. When the Terminal was taken over by the Baltimore & Ohio, he became traveling engineer and later master mechanic of the Baltimore & Ohio Chicago Terminal. He resigned to become a sales representative of the Boss Nut Company, of which he became manager of the sales department and then

(*Continued on second right-hand page*)

The BALANCE



General Motors Diesel Switchers are speeding up terminal and yard operations with maximum protection to cars and lading.



General Motors Diesel Road Locomotives in passenger and freight service are playing a vital role in the movement of our fighting forces and materiels.

Santa Fe

GENERAL MOTORS
LOCOMOTIVES

general manager. Later he was appointed vice-president of the American Bolt Corporation. In 1925, he and the late John A. MacLean, Sr., founded the MacLean-Fogg Lock Nut Company, of which Mr. Fogg has served as vice-president and general manager of sales since its organization. Throughout his career, Mr. Fogg had been active in the work of railway supply associations. For the last 25 years he was treasurer of the Western Railway Club and in 1937 was its executive secretary. For a number of years he was a director of the Car Department Officers' Association and at the time of his death was president of the Allied Railway Supply Association, Inc., and a member of the board of the Railway Supply Manufacturers Association.

◆

A. REAMY JOYCE, district sales manager of the Wood Preserving division of the Koppers Company, at Marietta, Ohio, died suddenly in that city on April 7.

Personal Mention

General

H. C. VINSANT, shop superintendent of the Texas & Pacific, has been appointed assistant mechanical superintendent, with headquarters as before at Dallas, Tex.

F. R. DENNEY, assistant mechanical superintendent of the Texas & Pacific at Dallas, Tex., has been appointed mechanical engineer, with headquarters at Dallas.

F. J. HERTER, mechanical assistant, office of chief mechanical officer—cars, of the Pere Marquette at Cleveland, Ohio, has been promoted to the position of mechanical engineer, with headquarters at Grand Rapids, Mich.

EDWIN J. KUECK, who has been appointed assistant superintendent of motive power of the St. Louis Southwestern, with headquarters at Pine Bluff, Ark., as announced in the April issue, was born at Sedalia, Mo., on June 26, 1892, and is a graduate of the Washington University (St. Louis, Mo.). He entered railroad service on September 6, 1907, as a messenger in the employ of the Missouri Pacific, and in 1909 became a machinist of the Atchison, Topeka & Santa Fe at Argentine, Kan. In 1914 Mr. Kueck returned to the Missouri Pacific as a draftsman at St. Louis, Mo., and three years later became a draftsman of the St. Louis Southwestern at Pine Bluff. He subsequently served as chief draftsman and acting mechanical engineer at Pine Bluff, becoming assistant superintendent of motive power on February 1, 1943.



Edwin J. Kueck

W. G. REID, assistant superintendent of motive power of the Southern Pacific at El Paso, Tex., has been appointed superintendent of motive power, with headquarters at El Paso. Mr. Reid was born at Cedar Rapids, Iowa, and entered the employ of the Southern Pacific in 1903 as a machinist apprentice at Tucson, Ariz. In 1907 he became a machinist in the employ of the Southern Pacific of Mexico at Guaymas, Son. From 1908 to 1913 he served as a machinist on the Arizona Eastern at Globe, Ariz., and in the latter year was promoted to the position of foreman and later to general foreman. In 1918 he became trainmaster at Globe and a short time later master mechanic at Phoenix. In 1924 he was transferred to El Paso. In July, 1941, Mr. Reid was appointed assistant superintendent of motive power at El Paso.



W. G. Reid

R. U. LIPSCOMB, superintendent of motive power of the Southern Pacific at El Paso, Tex., has retired.

A. C. HOWARD, assistant mechanical engineer of the Pere Marquette, with headquarters at Detroit, Mich., has been transferred to the staff of the chief mechanical officer, at Cleveland, Ohio.

CARL E. JOHANSSON, chief car draftsman, Advisory Mechanical Committee, of the Pere Marquette, has been appointed mechanical assistant—cars, office of chief mechanical officer, at Cleveland, Ohio.

RALPH D. BRYAN, engineer of car construction of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed to the newly created position of mechanical assistant at Chicago.

MINOTT BROOKE has been appointed fuel service agent of the Chesapeake & Ohio, with headquarters at Huntington, W. Va., succeeding G. G. Ritchie, who has been granted leave of absence to enter the armed forces.

CLARENCE JEPSEN, Diesel maintainer of the Chicago, Burlington & Quincy, has been appointed mechanical inspector in charge of passenger motor cars and Diesel equipment of the Eastern district, with headquarters as before at Chicago.

D. R. CALLERI, master mechanic of the Rio Grande division of the Southern Pacific at El Paso, Tex., has been appointed assistant superintendent of motive power, with headquarters at El Paso.

Master Mechanics and Road Foremen

A. H. JOHNSTONE, assistant master mechanic of the Southern Pacific at West Oakland, Calif., has been appointed master mechanic of the Rio Grande division, with headquarters at El Paso, Tex.

DAVID BEATH, division master mechanic of the Canadian Pacific at Moose Jaw, Sask., has been transferred to the position of division master mechanic at Calgary, Alta.

H. E. LOGAN, road foreman of the Chicago, Burlington & Quincy at St. Joseph, Mo., has been appointed to the newly created position of assistant master mechanic of the St. Joseph division, with headquarters at Kansas City, Mo.

J. M. VANCE has been appointed master mechanic of the Kentucky & Indiana Terminal, with headquarters at Louisville, Ky., succeeding R. P. O'Neil, who has resigned.

F. D. KENNEDY, master mechanic of the Erie at Avoca, Pa., has been transferred to the position of master mechanic at Marion, Ohio, succeeding C. J. Gerbes, who has been granted a leave of absence.

H. I. PHELPS, general foreman of the Erie at Jersey City, N. J., has been appointed master mechanic, with headquarters at Avoca, Pa.

R. W. WILSON, general foreman of the Canadian Pacific, has been promoted to the position of division master mechanic, with headquarters as before at Moose Jaw, Sask.

(Turn to second left-hand page)


★ ★ APRIL 10th ★ ★

★ ★ WAS M-7 DAY ★ ★ ★

Schenectady celebrated the completion, one year ago, of the "tank killer" that helped turn the tide at El Alamein.

It was built without a blueprint. It was asked for in three months—and completed in less than three weeks. It was a military secret exposed to constant public view — yet when it appeared at El Alamein it was a complete surprise to the enemy.

Rommel had never seen anything like it before —and probably never wants to see anything like it again. For this strange hybrid monster—a combination of 105 mm. howitzer and M-3 tank—expertly handled by the men of the British Eighth Army, left 500 Nazi tanks in wreckage and flames and helped start the so-called "Desert Fox" on his way back to Berlin.

One year ago it rolled off the assembly lines in Schenectady. It was then called, technically, the M-7. In its baptism of fire, it was given the much more descriptive name of "tank killer".

The men and women who were in on its birth had a rough idea of its importance. But they never realized that this deadly product of their skill and effort would play so vital a part in one of the most decisive battles of history—a battle, the successful outcome of which enables us of the United Nations to speak with hope today of the post-war world. Before El Alamein, no one dared think in those terms.

On April 10th we celebrated the appearance of the first M-7, in humble gratitude that we in Schenectady could contribute to a decisive victory thousands of miles away and so heighten the hopes of freedom-loving people everywhere.

To the following goes full credit for the amazing job the M-7 has done . . .

1 To its designers and engineers for their Yankee courage and ingenuity in building the M-7 in record time.

2 To the 10,000 men and women at the Schenectady plant who pitched in to turn the M-7 out in sufficient numbers to turn Rommel.

3 To the populace of Schenectady—who saw the M-7s rumbling through the streets—and kept their lips discreetly buttoned.

4 To the American railroads for the splendid job they did of getting every M-7 to its point of embarkation.

5 To the United States Navy for transporting these tank killers across thousands of miles of water and delivering them safely.

6 To the heroic men of the British Eighth Army whose expert use of the M 7 finally blasted Rommel's hopes of getting through to Suez.

7 And to the hundreds of sub-contractors and suppliers, and others, for their unflagging cooperation in the building of this mighty weapon of war.

★

AMERICAN LOCOMOTIVE

MANUFACTURERS OF MOBILE POWER

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, MARINE DIESELS, TANKS, GUN CARRIAGES & OTHER ORDNANCE

L. E. QUIRIN, general foreman of the Chicago, Burlington & Quincy at West Burlington, Iowa, has been appointed to the newly created position of master mechanic of the Chicago Terminal, with headquarters at Chicago.

C. I. CLUGH, who has been appointed master mechanic of the Philadelphia Terminal division of the Pennsylvania, with headquarters at Philadelphia, Pa., as announced in the March issue, was born on May 14, 1901, at Altoona, Pa. In 1926 he received the degree of B.S.M.E. at Purdue University. He began his railroad career on June 4, 1918, as a machinist apprentice in the employ of the Pennsylvania. He became a machinist on June 22, 1922; a special apprentice on July 10, 1923; motive power inspector on September 18, 1926; gang foreman on March 15, 1930;



C. I. Clugh

enginehouse foreman on December 1, 1936; assistant master mechanic on May 1, 1937; enginehouse foreman on June 16, 1938; resident material inspector on March 15, 1939; acting chief material inspector on February 15, 1941, and master mechanic at Philadelphia on February 1, 1943.

FRANK REVANA, general foreman of the Erie at Cleveland, Ohio, has been appointed master mechanic of the Mahoning Division, with jurisdiction over Cleveland, Brier Hill, Niles, Leavittsburgh, Akron, and Ferrona, Pa.

C. R. JOHNSON, who has been on furlough from the Central of Georgia since December 16, 1942, has resumed his duties as road foreman of engines of the Macon division of that road. Mr. Johnson's headquarters are at Macon, Ga.

Car Department

M. RUSSELL BUCK, assistant to the engineer of car construction of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed engineer of car construction at Topeka.

C. F. WEAVER, who has been appointed assistant general superintendent of car equipment of the Canadian National with headquarters at Toronto, Ont., as announced in the March issue, was born at London, England. He entered railway service in 1919 as a carpenter in the Montreal (Que.) car shop of the Canadian National, and subsequently served successively as assistant foreman and as superintendent of car shop until October 1, 1928,



C. F. Weaver

when he became superintendent of car equipment of the Montreal district. In 1937, Mr. Weaver was appointed superintendent of car shop at London, Ont., the position he was holding prior to his appointment as assistant general superintendent of car equipment.

Shop and Enginehouse

A. HOPKINS, machine inspector of the Chesapeake & Ohio at Hinton, W. Va., has been promoted to the position of assistant enginehouse foreman at Hinton.

C. A. KOTHE, general foreman of the Erie at Meadville, Pa., has been appointed shop superintendent, Meadville production shop.

C. M. STUBBS, enginehouse foreman of the Erie at Jersey City, N. J., has been promoted to the position of general foreman, with headquarters at Buffalo, N. Y.

F. C. JOHNSON, division master mechanic of the Canadian Pacific at Calgary, Alta., has been appointed locomotive foreman at Sutherland, Sask.

Purchasing and Stores

T. F. MURPHY has been appointed purchasing agent and storekeeper of the Spokane International, with headquarters at Spokane, Wash.

H. A. PAAR, division storekeeper of the Michigan Central at Jackson, Mich., has been appointed assistant general storekeeper of the New York Central at Beech Grove, Ind.

H. O. WOLFE, assistant to the purchasing agent, of the Baltimore & Ohio has been appointed purchasing agent of the Alton, with headquarters as before at Chicago, succeeding W. S. Galloway, who continues as purchasing agent of the B. & O., at Baltimore, Md.

Trade Publications

Copies of trade pulications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

"OXYACETYLENE FLAME ADJUSTMENTS."—Air Reduction, 60 East Forty-second street, New York. Natural color photographs to guide the student in adjusting the oxyacetylene flame.

◆

BRAZING ALLOYS.—Handy & Harman, 82 Fulton street, New York. Revised eighteen-page illustrated Bulletin No. 12-A descriptive of low temperature brazing of metals with Sil-Fos and Easy-Flow alloys.

◆

HICYCLE PORTABLE ELECTRIC TOOLS.—Chicago Pneumatic Tool Company, 6 East Forty-fourth street, New York. Catalog No. 900. Section 1—Drills and reamers; Section 2—Screw drivers, nut runners, stud setters, tappers; Section 3—Radial arms; Section 4—Grinders, sanders, buffers, polishers.

◆

CONTOUR SAWS.—Doall Service Company, 1201 Thacker street, Des Plaines, Ill. Illustrated text book of 265 pages on latest techniques for contour machining: internal and external three-dimensional parts for short-run forgings, multiple identical parts in one operation for short run stampings, and facilities for handling both massive or small jobs.

◆

FOAMITE FIRE-FIGHTING CAR.—American LaFrance Foamite Corporation, Elmira, N. Y. Four-page bulletin descriptive of Foamite Fire-Fighting Car for use in fighting fires on right-of-way, especially those common in derailments of cars hauling flammable liquids. Center pages show layout of fire-fighting equipment for adaptation to any freight car approximately 50 ft. in length.

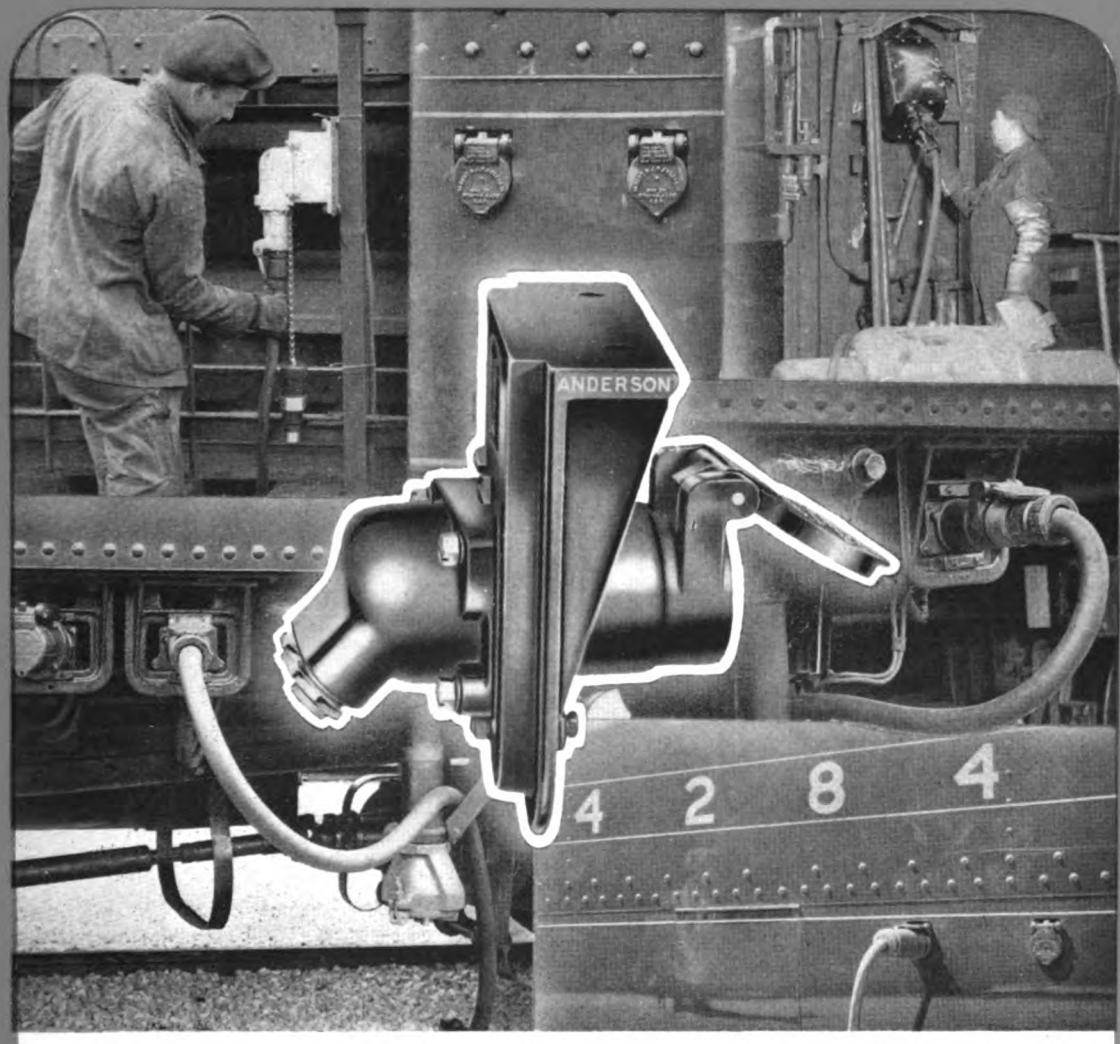
◆

STRAIN GAGE.—Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia, Pa. Twenty-four page Bulletin No. 171 on SR-4 strain gage. Gage consists of one, or a properly oriented group of two or three, fine wires cemented to the surface subject to stress change. These are connected, in the simplest arrangement of parts, to a portable Wheatstone bridge unit, the unbalance of which becomes a measure of stress change.

◆

OPTICAL COMPARATORS.—Jones & Lamson Machine Co., Springfield, Vt. Twenty-page spiral-bound booklet entitled "Beyond a Shadow of a Doubt." Presents advantages and possibilities of inspection of production parts and measurement of tools and gages by comparison, by optical projection, of a part with a master template or outline. Illustrates many tools and parts, inspection of which is being done with the comparators, also a number of steps in the building of the comparators.

ANDERSON'S ADVANTAGES ARE MANY



ALL Anderson products are made of high grade material by expert workmen to strict specifications, hence they will serve your railroad faithfully over a long period of time.
In these times of stress such features are dominant factors in preventing delays in shop work in the yards and on the road. It pays to specify Anderson Plugs and Receptacles.

ARMY E NAVY

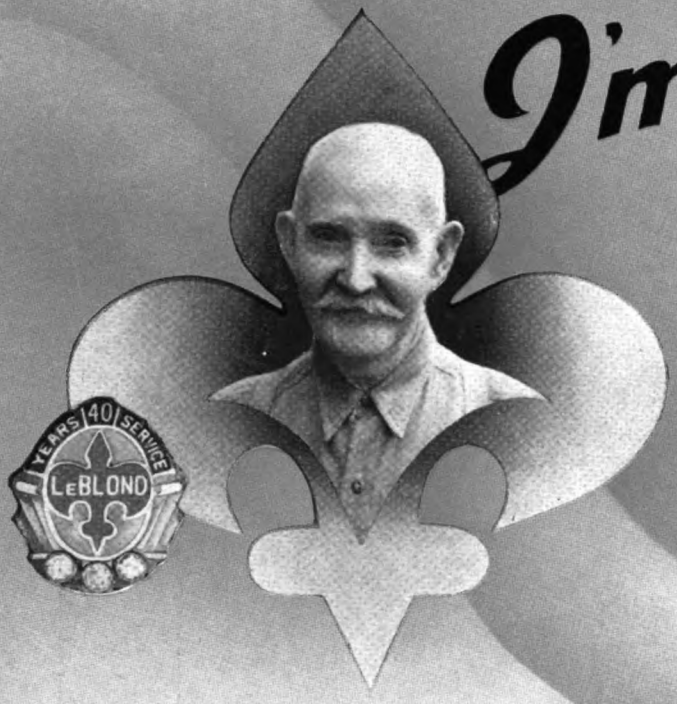
ALBERT and J.M. ANDERSON MFG. CO.

289-305 A Street, Boston, Mass.

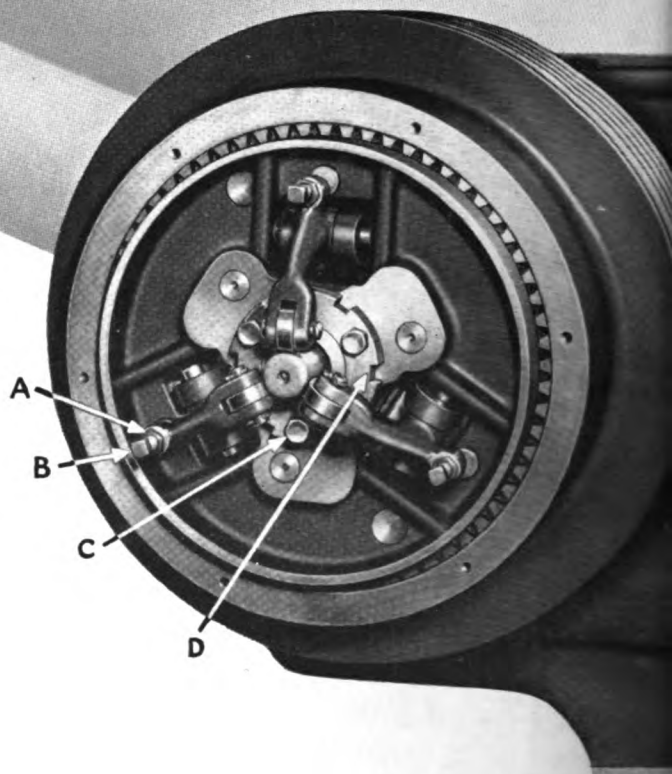
NEW YORK **CHICAGO** **PHILADELPHIA** **LONDON**

I'm Tellin' You

No. 10 in a Series of Tips on "Keeping 'em Turning"
by Tom Toker, 40 years at LeBlond



Any lathe requires adjustment from time to time. H
often depends on the type of operation and sometimes
the operator. Although it is seldom needed, the clutch
one spot to watch. If I tried to explain the "whys and whe
fores" of the mechanics involved in the LeBlond clutch
would take several of these pages, which the "front of
boys" assure me can't be bought with marbles. So with
going into details, here are two symptoms of trouble a
their remedies:



Loss of power — When the lathe slows under cut and the flow of power is irregular or jumpy, it's a pretty fair sign that the clutch is slipping.

Here's the remedy:

1. Put clutch in engaged position.
2. Drain oil through plug at bottom of clutch cover.
3. Remove the six screws to take off cover.
4. Loosen three lock nuts on clutch fingers (A).
5. Turn three screws equal degrees to the right (B).
6. Tighten three screws (B) until belt slips when spindle is blocked. With even adjustment, push rod will run dead center.
7. Tighten lock nuts (A).
8. Replace cover, refill with oil.

Hot clutch box — When there is too little clearance between the clutch plates while the lathe idles, friction overheats the non-circulating oil, breaking down its lubricating properties. When this happens, the cover plate will be hot to the touch.

Here's what to do:

1. With the oil drained, cover plate removed and clutch engaged, remove three screws (C).
2. Use a spanner wrench to tighten lug nut (D).
3. After checking manual for exact number of turns, back off lug nut. Check with feeler gauge the space specified between clutch hub and adjusting nut.
4. Replace screws (C) to draw clutch assembly tight against nut in proper operating position.
5. Replace cover plate and refill with oil.

ARMY E NAVY

THE R. K. LeBLOND MACHINE TOOL C
CINCINNATI, OHIO

Largest Manufacturer of a Complete Line of Lath

Transportation Library

JUN 1 1 1943

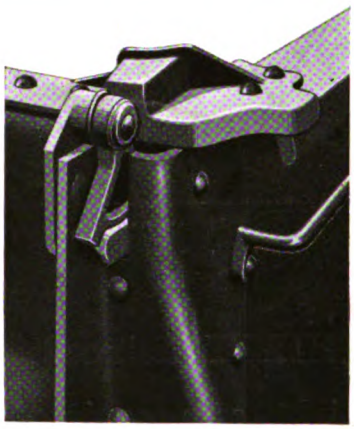
June 1943

Railway Mechanical Engineer

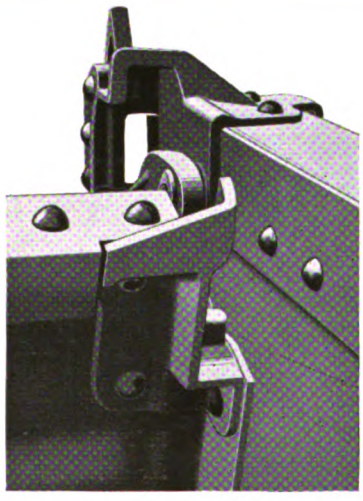
With which is incorporated RAILWAY ELECTRICAL ENGINEER

RIGID

...AS A SOLID END CAR



STURDY RUGGED INTER-LOCKING TOP CORNER





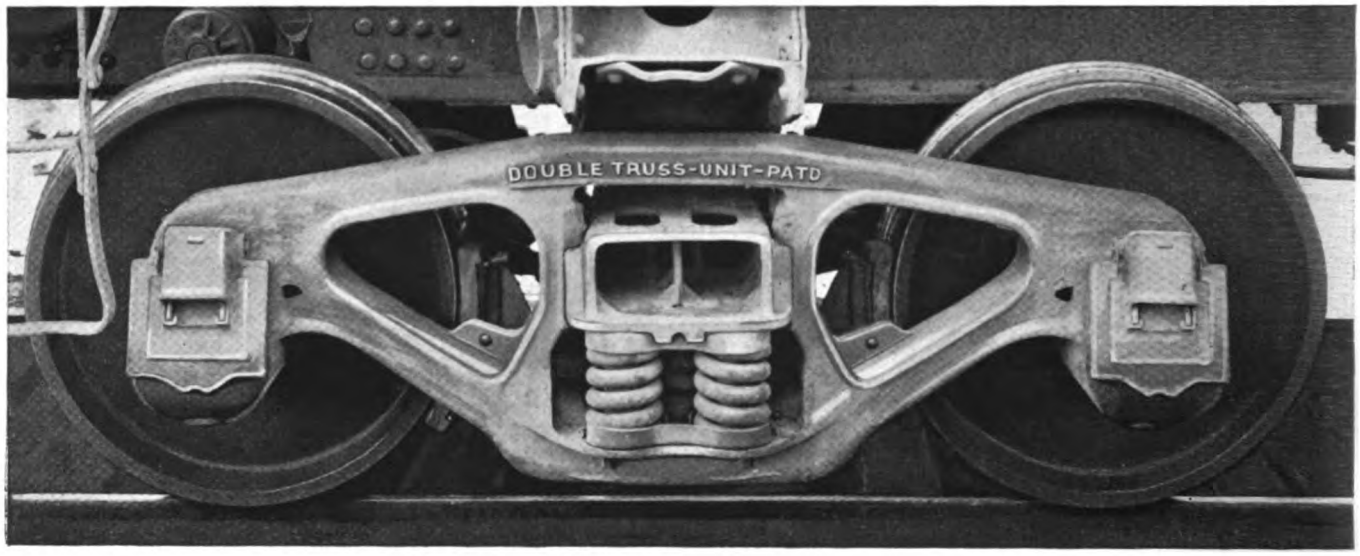
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THE WINE RAILWAY APPLIANCE CO. TOLEDO, OHIO

DROP END LOCK FOR GONDOLA CARS

UNIT TRUCK

LOOKING TO THE FUTURE



THIRTY Railroads have purchased and are running 15,000 freight cars equipped with UNIT TRUCKS and UNIT BRAKE BEAMS.

The savings in maintenance cost plus added safety in operation will keep these cars running for many years with a greater advantage than ever before.

Approved for Interchange.

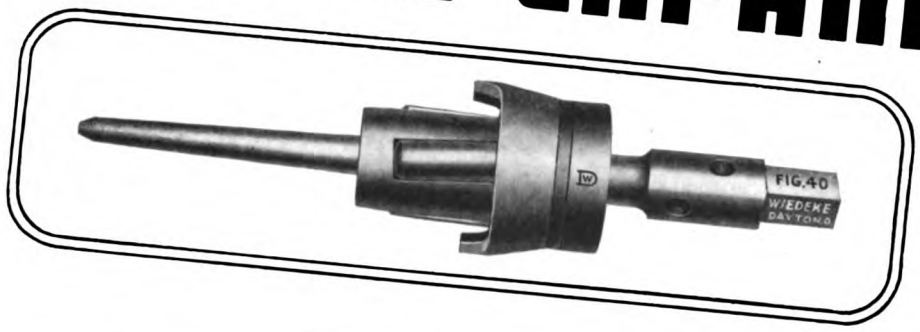
Full information as to licensees authorized to manufacture Unit Trucks will be furnished upon request.

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THE EDITOR'S DESK

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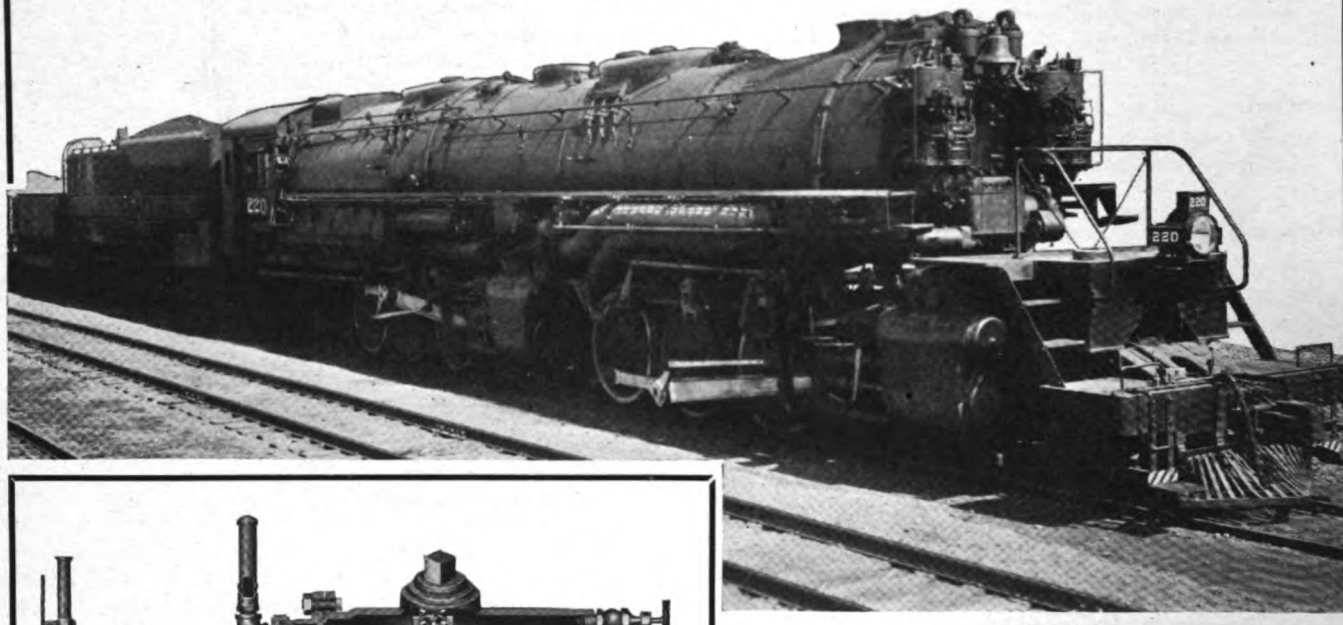
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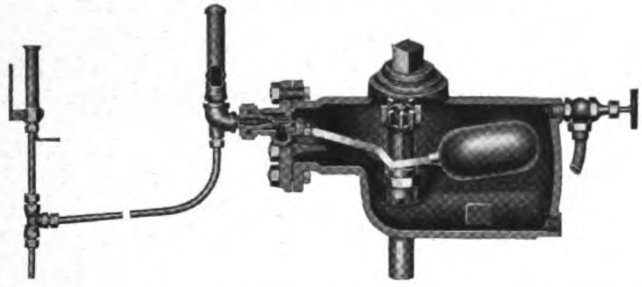
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RAILWAY
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Locomotive

Steam Distribution*

Part I

By Walter Smith†

Concise review of principles which brings into focus the relationship of the numerous factors affecting steam consumption and cylinder performance in the reciprocating steam locomotive

Fundamental Conceptions

The steam locomotive is fundamentally a machine for transforming heat energy into mechanical work. In this transformation of the latent heat of fuel into drawbar pull, steam is used as the medium of transmission, and three fundamental forces must be held in equilibrium. They are boiler power, cylinder power, and tractive power.

Boiler Power

This is the controlling factor, and is limited by the rate at which steam may be generated in a given time by a boiler of permissible size and weight. Formerly, the high speed performance of locomotives was determined by the ability of the boiler to supply steam. However, during the past twelve or fifteen years the boiler has been intensively developed to the extent that an enormous increase in the volume of steam which can be delivered to the cylinders for a given weight on driving wheels has been provided. This larger steaming capacity has been made possible by the use of four-wheeled engine and trailer trucks, combined with increased superheat and feed water heating. Alloy steel boiler plate has also played a part in making it possible to build larger capacity boilers, without increasing the weight on drivers.

The locomotive boiler as a heat absorbing mechanism functions very nearly uniformly on an average about 75 per cent and as high as 82 per cent efficiency. Obviously, any further advance in locomotive boiler efficiency must depend on improving the combustion rather than the heat absorption. Finally, in this connection it may be well to emphasize the fact that boiler efficiency depends only on the rate at which the steam is produced; it is definitely not affected by the speed and cut-off at which the cylinders are worked.

Cylinder Power

As the boiler is the important element in converting the potential energy of the fuel into that of the steam, so the cylinders serve as the means of converting this potential into dynamic energy. The size of the cylinders (diameter and stroke), together with the diameter of the driving wheels, represent the power of the locomotive from the point of view of the engine. It is a well known fact that small cylinders are more efficient than large ones, but reduced cylinder diameter unless accompanied by higher boiler pressure means reduced initial accelerating capacity. Cylinder action is gauged by mean effective pressure, and the average pressure which can be exerted against the pistons depends upon the quantity, pressure, and temperature of the steam admitted at the beginning of the stroke, up to the point of cut-off.

In comparing the relative importance of the boiler and cylinders, the fact must not be overlooked that at best the efficiency of the engine is much lower than that of the boiler. It is well known the cylinders can only transform into useful work from 8 to 12 per cent of the energy stored by the boiler. On the other hand, from the foregoing we know that the efficiency of the boiler relative to the heat units supplied to it is around 75 per cent. Consequently, a valve and cylinder arrangement which can effect a saving of 1 per cent in efficiency in the use of the steam generated will (other factors being equal) result in at least as much net economy as an increased efficiency of about 8 per cent in the boiler alone.

Tractive Force

Tractive force is the force developed by the cylinders at the rim of the driving wheels, and hence the adhesion between drivers and the rails is the controlling factor. Consequently, tractive force is a function of the weight on drivers, and is limited by the maximum permissible axle load, which is usually about 70,000 pounds per axle. The absolute limit of tractive adhesion between a steel tired wheel and a steel rail is about one-third of the pressure, but not more than one-fourth of the weight on the drivers can be depended on for adhesion and wet rails will often reduce this to one-fifth or even less. Hence

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†Western manager, Pilliod Company.

the necessity for loading the drivers as much as possible.

It is clear that a given traction may be secured with small changes in the details of the machinery and cylinders or a given adhesive weight may be utilized by proportioning the cylinders accordingly, assuming a fixed boiler pressure. From all this, it is readily apparent that the cylinder power is the most easily controlled factor.

At this juncture, it may be well to clarify the relationship between tractive force, draw-bar pull, and horsepower. Draw-bar pull is the important factor, and it is derived from the tractive force by subtracting from it the engine and tender resistance. Without going into details, it may be stated here briefly that the tractive force and draw-bar pull decrease as the speed increases, while the indicated horsepower increases with the speed. Power is the product of force times velocity. Hence if the power is constant and the velocity increases the force must decrease. To sum up: it is only at very slow speeds that a locomotive can utilize all of its tractive force, and when running at high speed the utmost horsepower that can be developed will only produce a draw-bar pull, which is but a small part of the possible tractive force.

Factors Affecting Cylinder Performance

From the foregoing it is apparent that the power which can be developed by the locomotive is determined by the rate at which the boiler produces steam, and by the rate at which the cylinders consume it. For example, suppose the boiler is capable of producing 80,000 lb. of steam per hour, then if the cylinders use 20 lb. per indicated horsepower per hour, the locomotive will be capable of delivering 4,000 hp. continuously. Naturally, the more efficient boilers can be made to deliver more steam, and the more efficient cylinders will deliver a horsepower upon the consumption of less steam. So this increase in efficiency may at the normal limit of power be utilized in the development of more power.

Steam Consumption

Likewise, boiler performance remaining unchanged, an improvement in steam utilization in the cylinders with a definite maximum quantity of steam will give an increase in the maximum power. Besides, the cylinders which show the least drop in tractive force as speed increases will develop the most power from each cubic foot of steam, and will thus be most efficient. A great deal has been said and written by observers outside of the railroad field derogatory to the thermal efficiency of locomotive cylinders. This is the percentage of heat in the steam flowing through the cylinders that is converted into useful work. But the fact remains that records as low as 15 lb. of steam per i. hp. hour have been achieved. This compares favorably with efficient non-condensing power plants. There are four ways of reducing the steam consumption and thereby increasing the thermal efficiency as well as the capacity of the locomotive: (1) By increasing the mean effective pressure by reducing wire drawing, lowering the back pressure and getting the best cycle of valve events possible. (2) By reducing the cut-off or increasing the expansion ratio. (3) By controlling compression to give maximum mean effective pressure for a given steam supply. (4) By increasing the specific volume of superheated steam by getting highest degree of superheat possible, and reducing the temperature drop as much as possible from header to cut-off point in cylinder. Reviewing the main facts, we see that the steam consumption is mainly a function of the percentage of cut-off at which the engine is operated. It is also a function of the pressure and the temperature of the steam both at the steam chest and at the point of cut-off, which leads up to a discussion of the importance of high pressure and high superheat.

High Pressure and High Superheat

An increase in pressure always means a gain in economy as far as the heat cycle of operations in the cylinder is concerned. When boiler pressure is increased, both the heat brought in is increased and the heat exhausted is decreased. Economy from high pressure lies in the fact that high power, or increased power, is produced without proportional increase of heat from the fire. In other words, by the addition of a comparatively small number of heat units per lb. of steam, pressure is greatly increased. Viewed from another angle, the possibility for using steam expansively are much improved, and utilization of high-pressure steam is a matter of using steam expansively.

The superior steam efficiency of high superheat is too well known to need elaboration. Suffice it to say that its principal advantage is derived from heat reserve and volumetric increase. It is well to remember in this connection that the degrees of superheat necessary to prevent cylinder condensation vary with the ratio of expansion, and as a result at short cut-offs superheat in the exhaust steam is greatly reduced. There remains to point out that the measure of the efficiency of the utilization of the high-pressure high-temperature steam is the difference in the heat content of the steam at admission and the heat content at exhaust after expansion has taken place in the cylinder.

Aside from all this, the highly vitalized steam from high boiler pressure and increased superheat gives effective cylinder action by going into the cylinders with explosive force.

The advantages of an increased pressure range and a higher superheat are indeed outstanding in nearly every respect. But the following facts should be borne in mind: There is more friction to the rubbing surfaces of an engine operated with high-pressure steam; also, the density of steam is increased with the pressure, and hence resistance to passage through the ports is greater. This important matter will be discussed under the heading of pressure drop.

Cylinder Diameter and Stroke

Not the least important of the advantages derived from higher pressure and a greater temperature range is the possibility of utilizing smaller cylinders. Obviously, the use of decreased cylinder volumes in connection with highly vitalized steam simplifies the problem of getting high cylinder mean effective pressure at high speed. Smaller cylinders make it possible to improve greatly the ratios between port and piston areas, and thus very much higher initial pressure is insured against the piston up to the point of cut-off. Increased wire drawing results from the use of large cylinders because piston area increases with the square of the diameter. Theoretically, the longer the cylinder with respect to its diameter the more favorable its performance. Offsetting this advantage, however, is the fact that the piston speed is higher with the longer stroke.

And finally there is the matter of machine efficiency, which is higher for small-cylinder engines than for those of larger diameter.

Diameter of Drivers

It has been a general rule in locomotive construction that the diameter of the driving wheels in inches should

be as great as the maximum speed in miles per hour. There are 336 revolutions per minute at diameter speed, and unless the stroke is excessive the piston speed is held within reasonable limits.

There is no lack of evidence to show that increasing the diameter of the drivers greatly increases the possible range of action. And further as it tends to diminish frictional losses, it serves in sustaining the draw-bar pull as the speed is increased. More important still is the fact that cylinder action is made more efficient because wire-drawing and back-pressure losses are reduced. As a result of these important advantages, high-wheel locomotives improve operating efficiency by economically increasing the power output in the high-speed ranges.

In the interests of efficiency and economy, it seems that piston speed at the maximum operating speed should be limited to about 1,600 ft. per minute. This in spite of the fact that some of the most notable examples of recent power have demonstrated the ability to develop maximum capacity at piston speeds up to 1,800 ft. per minute. In this connection it should be noted that valve and cylinder lubrication becomes critical at the maximum piston speeds.

Mean Effective Pressure Gauges Cylinder Performance

Present-day operation demands maximum ton miles per train hour. Which in turn calls for sustained tractive force at relatively high speed—that is, high horsepower output. Formerly locomotives were rated by their maximum tractive force, but present operation necessitates rating locomotives at the power which they will deliver at the maximum operating speed. As has been shown this means large boiler capacity and economy in the use of steam combined with a high mean effective pressure. Mean effective pressure is the yard-stick which measures the power developed in the cylinders. It depends on the admission pressure, exhaust pressure, cut-off, and the effectiveness of steam distribution.

Effect of Speed and Cut-off

For a given cut-off, there is a falling off in mean effective pressure as the speed increases for the reason that the initial and admission pressure decreases, and back pressure increases at the greater piston speed. Losses in initial and admission pressure with speed are due to the aforementioned wire drawing, and are proportional to the rate at which steam is used. It can probably be shown as a general rule that the cylinder tractive force for a given cut-off falls off in a straight line relation as the speed is increased. The loss in mean effective pressure due to speed is rather startling. With a given cut-off, each increment in speed reduces the mean effective pressure for the reason that the period of opening is reduced, from which it follows that there is less steam admitted per stroke. All this in spite of the fact that the extent of port opening does not change, unless there is a distortion of the valve gear. When attempts are made to increase the power output by means of a longer cut-off the results are as follows: the back pressure goes up, and the initial pressure shows a tendency to taper off. Virtually, the same wire drawing as before takes place, and hence the rise in back pressure may neutralize the gain.

Standards of Comparison

To state the case briefly, the measuring-rod of effectiveness of steam action is speed, power, and economy. In establishing the relative merits of different designs and arrangements of valves, valve gear, and cylinders, it is always useful to set up a standard of comparison. As already pointed out, there is no more accurate gauge of cylinder effectiveness than mean effective pressure. Moreover, the efficiency of steam distribution, with other things being equal, should be proportional to the saving in steam consumption. Consequently, the standard of comparison for determining the effectiveness of different valve and valve gear arrangements should be the mean effective pressure developed, and the corresponding steam consumption for given speeds and cut-offs. Putting the emphasis on speed, it can be said that the best possible valve arrangement is the one that will give the highest mean effective pressure at the highest speed, with the least steam consumption, and with the smallest horsepower loss from back pressure. And this brings us to another method of determining cylinder performance—that is, by means of the steam engine indicator.

Indicator Diagrams

The behavior of steam in locomotive cylinders is not always predictable. In consequence, it is necessary to have some means of determining what is taking place under different operating conditions. The steam-engine indicator admirably meets the requirement in this respect. It is an instrument designed to make an accurate graphical diagram of the pressure of the steam in the cylinder at all points of the stroke. Indicator diagrams serve to disclose faulty steam distribution, and point out where valve events can be improved. Interpreting high-speed indicator diagrams is usually difficult for the reason that the steam line is almost always wavy, and the phases of the cycle poorly defined. Another basis of comparing efficiency is afforded by these cylinder cards. An indisputable index of efficiency and economy accomplished by the valves and gear can be arrived at, by determining from the cards the proportion that mean effective pressure bears to initial pressure (not boiler pressure).

Design Features Tending to Give Greater Cylinder Efficiency

Pressure Drop, Boiler to Cylinders

Among the outstanding developments and tendencies is the streamlining of the steam circuit in order to reduce wire drawing. There has been increasing recognition of the fact that pressure losses between the boiler and cylinders are responsible for a considerable loss of cylinder mean effective pressure. As a result more attention is being directed to the matter of getting freer steam flow through the different elements. It is well known that the steam is not only wire drawn in passing the valves, and through the ports and steam passages to the cylinder, but from the time it leaves the steam space in the boiler. In view of all this, recent high-powered locomotives have been provided with enlarged dry pipes and steam pipes, large-element Type E superheaters, and enlarged steamlined ports in the cylinders. Besides, in some cases, the throttle capacity has been increased. These features all combine to effect a reduction in the pressure drop between the boiler and cylinders by reducing steam velocities. With the aforementioned parts properly proportioned, a steam velocity of about 2,500 ft. per minute in the saturated section is obtained, and approximately 5,000 ft. per minute in the superheated section of the steam circuit. The high demand for steam under severe operating conditions necessarily requires high velocity in steam passage in which the pressure drop or frictional loss is proportional to the velocity.

Volumetric Increase of Valve Chambers

Another element of design, which tends to give greater power output, is the enlargement of valve chambers. This feature provides an increased volumetric capacity adjacent to the cylinder, and is helpful in holding up the initial pressure when steam is being drawn off rapidly at high speed. In this connection it may be well to point out that increasing the size of the steam pipes gives practically the same effect.

Design of Cylinder Ports

From the standpoint of cylinder efficiency nothing is more important than a properly designed cylinder. At very high speeds the ability to pass steam to and from the cylinders is the limiting factor. Hence port and passage area is the controlling factor, providing that the steam is not unduly restricted in passing the valves. This phase of the problem will be discussed later. Ports should be designed in conformity with the well known principles governing the flow of gases which are employed so successfully in steam-turbine construction. Minimum resistance to the flow of steam should be insured by revising the size, shape, length, and smoothness of the passages and ports, so that eddies and baffling are eliminated. In view of all this, the spacing of ribs should be given especial attention.

Regarding the size of the passage, the unfortunate fact arises that cylinder clearance volume varies with the area of this element. Hence, in the past it was the practice to accept a certain amount of port restriction in order to keep the cylinder clearance within prescribed limits. The problem was still further complicated on account of the increased wire drawing resulting from the use of large cylinders. As already stated, piston area increases with the square of the diameter. Consequently, the steam ports of large cylinder engines were seldom proportionally as large as the passages of those with small cylinders. At that time the rule was to proportion cylinder ports as near 9 per cent of piston area as possible. Since the introduction of higher boiler pressures, and the accompanying smaller cylinders, the problem has been somewhat simplified. And as a result, cylinder ports as large as 11 or 12 per cent of piston area have been provided in some cases. There is still no uniformity of practice in this regard, but 10 per cent of piston area can be considered the prevailing rule.

Exhaust Passages

Equally important with the preceding consideration is the matter of exhaust passages. At high speed, there is as much difficulty getting the steam out of the cylinders as there is getting it in. The pressure is reduced and the velocity of the steam low after it is released from the cylinder. Hence full advantage should be taken of advanced practices in design to minimize resistance to the escape of exhaust steam. And this means streamlined passages with flowing lines, easy curves, and smooth surfaces. Respecting the proportions of the passages, it may be said that cross-sectional areas 11 or 12 per cent of piston area are required for best results. When exhaust passages are properly proportioned each increment in back pressure should produce a like increase in draft.

Wire Drawing Defined

In concluding this discussion of pressure losses in the steam circuit, it may be well to define wire drawing. Probably the best and simplest definition is that wire drawing is in fact a case of imperfectly resisted expansion. Standing out is the fundamental fact that wire drawing in high-speed locomotive operation is unavoidable. And all that can be accomplished is to minimize the extent of its influence.

Control of Steam Distribution

Reverting back to fundamentals, we find that in the dynamic operation of a locomotive steam engine action in the cylinders is accomplished by four stages as follows: steam admission, expansion, exhaust, and compression. The function of the valves and valve actuating mechanism is to control these phases, and the process is known as steam distribution. Getting effective steam distribution is a matter of controlling time, sequence, and volume of steam. Finally, in this connection it remains to state that the exact points of piston stroke at which pre-admission, cut-off, release, and closure occur are determined by the valve events, which are the periods during its travel when the valve and port edges register.

From a consideration of the fundamental principles which govern the flow of steam to and from the cylinders, we find that there are three elementary variables which may be used by the designer to obtain the desired steam distribution. These are lead, steam lap, and exhaust clearance, and the best combination is generally secured by experiment and experience. It is characteristic of the piston valve and our present radial valve gears that these elements remain constant throughout the whole range of operations. Then there are other important factors to consider which vary with the point of cut-off. These are the port openings—admission and exhaust—and valve travel.

Lead

Lead is the width of steam port opening at the beginning of the stroke. It causes pre-admission and controls the zone of power by virtue of its ability to hasten or retard all of the events of the stroke. Time is a vital factor in the control of steam, and lead is the time factor. Another fact of interest in connection with lead is that it establishes the admission port opening in the shorter cut-offs. Hence considerable lead is necessary in order to get sufficient port opening for high-speed operation. However, it must be borne in mind that although the lead remains constant, the pre-admission varies, and becomes greater as the lead is increased, and as the cut-off is shortened. To make this point clear pre-admission may be defined as the distance the piston must move to complete the stroke after the valve begins to open for lead. Already it becomes plain that pre-admission creates negative work, and hence it is logical to assume that the detrimental effect of excessive pre-admission will be greater from the highly energized steam resulting from high pressure and increased superheat. All this leads to the conclusion that it is not practicable to increase the lead greatly. The opinion has been advanced frequently that starting power is retarded by lead in full gear. Few assertions could be more misleading. Whatever the theory may be the fact remains that although lead causes pre-admission, the valve movement in full gear is so rapid while uncovering the port that less than $\frac{1}{16}$ in. pre-admission results from $\frac{1}{4}$ in. lead.

Steam Lap

Steam lap is the distance the steam edges of the valve overlap the ports when in mid-position. Its function is to control expansion and pre-release. The important thing to keep in mind about steam lap is the governing effect it has on travel and cut-off. Valve travel determines the cut-off, but in turn travel is principally a func-

tion of steam lap. In mid-gear travel is equal to twice the sum of the steam lap and lead, and for any given cut-off, the travel is twice the sum of steam lap and port opening. Let us consider now the effect that steam lap exerts on starting power. The inherent difficulty is that lap hastens the cut-off and necessarily shortens the period the port is open. All this means that a long valve travel is required in order to insure sufficient full gear cut-off. Formerly it was considered necessary to provide 85 per cent maximum cut-off in order to insure starting reliability. That necessitated a maximum valve travel five times greater than the sum of lead and steam lap. Or, to put it the other way around, the sum of lap and lead could not exceed 20 per cent of valve travel. A very definite recent trend is toward a restricted maximum cut-off in order to utilize the outstanding advantages of wider steam lap. Evidently, the important fact is that of effectiveness at high speed, with less emphasis upon starting power.

Exhaust Clearance

Exhaust clearance, sometimes termed exhaust lead, is the width of port uncovered by the exhaust edges of the valve when in mid-position. It causes a shortened expansion period, reduces compression, and increases exhaust port opening. By hastening the point of release, exhaust clearance increases the interval of time during which the exhaust port is open. There is another aspect of this matter that is often overlooked. At first sight, it might seem that by increasing the exhaust clearance and thus widening out the exhaust port opening, and hastening the point of release that the exhaust should be made freer and the back pressure lowered. Within limits this is true, but a point can be reached where the pressure is so much higher at the point of release that the back pressure will increase. This accounts for the fact that engines with the largest exhaust clearance have the sharpest exhaust. To offset this undesirable effect, an appreciable gain in mean effective pressure can be secured from increased exhaust clearance. This is accomplished by delaying the closure point, and thus confining the negative pressure to a smaller percentage of the stroke. Here, as always, steam consumption will indicate the answer.

Travel and Port Opening

It remains to consider port opening and travel, which are very important factors in steam distribution. Always bear in mind that admission and exhaust port openings, and the valve travel vary with the point of cut-off. But that for any given cut-off, they are a function of the lead and steam lap. Besides, exhaust port opening is a function of exhaust clearance. At this point it should be understood that port opening is closely allied with lead. In fact the relationship is so intimate in mid-gear that port opening and lead are the same, and in the short cut-offs port opening is the lead plus a small increment, depending upon the width of steam lap. As regards travel, it should be observed that for any given cycle of valve events it is twice the sum of the steam lap and the port opening. Furthermore, that in mid-gear the travel is twice the sum of the steam lap and lead. Also, bear in mind that in order to get sufficient maximum cut-off, it is necessary to resort to over-travel of the ports in full gear. To which it may be added that a general rule can be laid down for port width as follows: Width of port in bushing should not be less than the sum of steam lap, lead, and exhaust clearance. It is probably superfluous to add that over-travel is a function of port width.

Back Pressure

In taking up this very important subject, it should be emphasized that cylinder efficiency is notably increased by decreasing the back pressure. To insure low initial back pressure the exhaust opening should be as wide as practicable at the beginning of the piston stroke. At this point the width of exhaust opening is lead plus steam lap plus exhaust clearance. From this, it follows that considerable lap is necessary to insure liberal exhaust opening. The point to bear in mind is that the final choking of the exhaust should come at the exhaust nozzle and not at the valve. It will immediately be observed that with this matter of back pressure is bound up the whole field of front-end efficiency, which is not within the scope of this paper. Suffice it to say that the nozzle should be of the highest draft-producing efficiency, combined with a stack which will give the greatest effectiveness.

Getting back to cylinder back pressure, it is necessary to point out that it varies directly with the admission pressure, the length of cut-off, speed, and the ability to maintain the initial pressure. Naturally, back pressure increases with increased speed because of the shortened time interval for the escape of steam. If steam is to be exhausted effectively and completely the valves must be of liberal diameter and the steam lap adequate, combined with streamlined passages of sufficient area. It will be sufficient to remark here that wide steam lap provides increased capacity for rapidly expelling large volumes of steam. The importance of this matter entitles it to some further consideration.

There is some truth in the saying that the limit of effectiveness at high speed is the ability to expel steam from the cylinders. No phase of steam distribution is more important. There is this to remember about back pressure: it increases with speed, but is less the greater the ratio of expansion. Consequently, short cut-offs at high speed tend to offset the increase in back pressure brought about by the higher piston speed. Some insight as to the effect of back pressure at high speed may be had by considering the fact that the negative work, including back pressure, compression, and pre-admission, may go up as high as 35 or 40 per cent of the effective power. Even under favorable conditions a loss of several hundred horsepower is not at all unusual. All this emphasizes the importance of the matter.

Compression

Closely connected with back pressure is the matter of compression. For a given cut-off both compression and back pressure increase with speed. Moreover, the back pressure becomes interfused with the compression at the closure point, and the combined pressures increase until the final compression pressure is not far below the initial pressure. It supplements the effect of pre-admission by filling the clearance space with a pressure nearly equal to the steam chest pressure. Unless compression produces a greater pressure than that of the steam chest it is not harmful to steam economy. At first sight it might seem that the power expended in compression was lost, but such is not the case. It gives back as much power on the return stroke as that expended in producing it, less frictional losses.

Let us consider now what happens when the cut-off is shortened. The inherent difficulty is that at the high points of cut-off the closure point comes earlier in the stroke, greatly increasing the compression. In addition to this, pre-admission increases in about the same ratio. All of which greatly increases the negative work and

(*Continued on page 262*)



Russell Gray Henley

Vice-Chairman, Mechanical Division

Russell Gray Henley

Capable mechanical department leader of the prosperous and extremely heavy density traffic railroad, the Norfolk & Western

THE Norfolk & Western occupies a unique position among American railroads. It has the greatest density of traffic of any railroad with a mileage in excess of 400; the net ton-miles per mile of road per day for the year 1942 were 24,940. Its nearest competitors were the Chesapeake & Ohio 24,159; Pennsylvania System 19,513; Delaware & Hudson 18,336; New York, Chicago & St. Louis 17,770; and Reading 17,292. The extent to which coal dominates the traffic is indicated by the fact that in 1942 the coal shipments totaled 53,878,415 tons, while all other commodities amounted to only 16,764,234 tons.

It is significant that all of the executive officers on the railroad have been intimately associated with each other over many years, as a result of which there is the closest of understandings and co-operation. During the depression the executives, with vision and foresight, made heavy expenditures for improving the equipment and facilities, in order that the road might be in better position to handle the business efficiently when conditions became more normal. When war started in Europe, the company embarked on a still larger program for the construction and purchase of new cars and locomotives and the expansion of key terminals and other facilities necessary to meet increased traffic demands incident to the war effort. These expenditures are bearing fruit today, although the fortunes of war are playing some queer tricks on the road.

Heavy expenditures, for instance, were made on expanding the facilities at Lamberts Point (Norfolk) at tidewater, for more expeditiously transferring the coal from the cars to colliers, which transported it coastwise as far north as New England. With the practical discontinuance of the colliers, these facilities are naturally being operated only at a low rate and the great bulk of the coal for the Northeast is being routed north over the single track, heavy grade line up the Shenandoah Valley and through Hagerstown, Md. This line, winding along the valley and never designed for heavy traffic, is being utilized to the very limit and far beyond what was considered to be its maximum capacity. Moreover, three times as much motive power is required for the handling of an equal tonnage, as compared to the even longer distance from Roanoke to the tidewater at Norfolk.

The mechanical department, an important factor in the operations of any railroad, has given an unusually good account of itself on the Norfolk & Western, and that fact is recognized generally in railroad mechanical circles. Russell Gray Henley has headed it up since 1928; he is also the vice-chairman of the Mechanical Division, A. A. R.

Henley's Early Career

What sort of a chap is Mr. Henley; what about his background and experience? Just what has he done on the Norfolk & Western—for it is the only railroad he has ever worked for, and he has been with it for many years?

Henley started his life as a country boy; he was born on a farm near the small town of Walkerton in King and Queen County, in the eastern part of Virginia. He attended high school in Lexington, Ky., following which his family moved to Richmond, Va.

What attracted him to the railroad field? Apparently he had had no special leanings in that direction. Friends of his family, however, were intimately acquainted with the head of the Richmond Locomotive Works and young Henley applied for an apprenticeship with that company. The plant at that time had about 2,000 employees, but did not maintain an apprenticeship training system.

Henley and another lad, Cary Fisher, were employed at about the same time as special apprentices. They had the run of the works, so to speak, and received a broad training, including plant maintenance, experience in the drawing room and engineering department, as well as training in the various shops which made up the plant. This was an excellent experience, with an emphasis upon production, which in those days, at least, was hardly to be found in a railway repair plant. It seems to have had a profound influence upon his life work, from his very start on the railroad to the present time, when the mechanical facilities under his control are quite generally regarded among the very best equipped and operated in the country.

There was a good technical night school in Richmond, known as the Virginia Mechanics' Institute. This afforded Henley an opportunity to study mechanical drawing and he enrolled in the Institute, which was then located at Eleventh and Broad streets. The text used was Meyer's Mechanical Drawing and Machine Design.

Starts Railroad Career

Richmond had no great attraction for the young man when he finished his apprenticeship, and after his mother died a friend persuaded him to leave that city and go into railroad work. On September 5, 1905, he entered the service of the Norfolk & Western as a machinist at Bluefield, W. Va. A little less than three years later, December 1, 1908, he was made assistant roundhouse foreman. He soon earned the reputation for thorough work and the ability to meet and overcome unexpected handicaps.

In June, 1911, he was transferred to Williamson, W. Va., as night roundhouse foreman. The general foreman was impressed by his ability "to keep things moving under some very trying circumstances. He was resourceful, energetic," says this old-timer. "He ran the large roundhouse at Williamson, having complete charge at night, which relieved me of a lot of worries and responsibilities.

due to the fact that no matter how hard a proposition came up, he dug himself out without calling for help."

Significant Incidents

A series of incidents occurred in these early years that throw interesting sidelights on the subject of this sketch and explain, in part at least, why, in a quiet and determined way, he has advanced to his present position and wields so great an influence. Incidentally, these stories have a wide circulation, and naturally have taken on a variety of embellishments; these we have eliminated by going to the original sources for the material.

A derailed locomotive had fouled itself, making necessary the stripping of the rods before it could be retracked and moved. A fast and furious effort was being made by none-too-competent men to remove the rods. They were trying to drive a pin out of an eccentric rod, when a quiet young man walked up. The ranking officer on the ground promptly said, "Look out there boy, that bolt will fly out and hit you." The young man replied, "Not the way he is hitting it; let me have the hammer." He took it and struck the rod on the side of the jaw; the pin "jumped out." The officer was impressed not only with the young man dressed in his street clothes coming forward, taking over and completing the job; but also by his insistence that the job be done without damage to any of the parts. On questioning, he found him to be a roundhouse machinist.

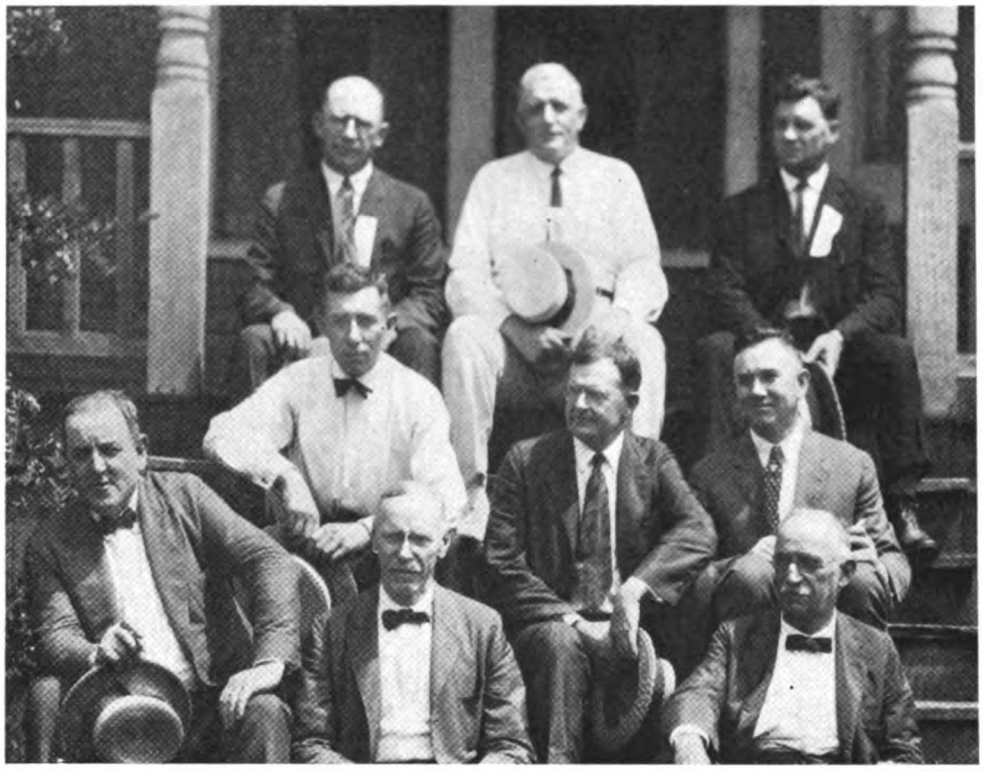
Several years later a serious fire broke out on the property of the company at a small town without organized or adequate fire protection. When the picture was the blackest, the night roundhouse foreman arrived on the ground with his entire force. Without any trace of excitement or commotion on his part he quietly and distinctly told each of his men just what they were to do. Their work was effective. The ranking officer on the ground observing the orderly activity of these men, when all else was in confusion, found that the foreman demonstrating his man-handling ability was the same young man who several years before had demonstrated at the derailment his personal willingness for work, his ability to do the job, and his insistence for economy.

In 1915 a large construction project, involving the double tracking of a section of the railroad, was under way near East Radford, Va. Tools were sent to the roundhouse at that place for sharpening, and repairs were also made to the work equipment. Great difficulty was encountered in having the work done promptly and satisfactorily, up to a certain point, after which things ran along smoothly and it was found that promises could be implicitly relied upon. A new foreman had been put on the job at East Radford—a chap named Henley.

As a matter of fact, Henley when he took the new job found that he was swamped with the work of repairing broken-down construction machinery and tools, and he was quickly impressed with the fact that nothing was sent to the shop until it had completely failed. At the first opportunity he visited the construction job and observed the delays due to machinery failures and slow drilling because of dull rock-drill bits. His suggestions that the machinery be sent to shop on Saturday evening, for repairs over Sunday and return to the job early Monday morning, and that the drilling bits be sent in each night for sharpening and return early the following morning, solved the problem.

After that his advancement was steady. He was made general foreman at Kenova, W. Va., in June, 1916; master mechanic at Bluefield, W. Va., February 15, 1918; master mechanic at Portsmouth, Ohio, November 1, 1918; assistant to the superintendent motive power, Roanoke, Va., February 1, 1924, and superintendent motive power, June 1, 1928. His title was changed to general superintendent motive power February 1, 1941, but he has headed the mechanical department since he was made superintendent motive power in 1928.

With each promotion to higher positions he took advantage of the greater opportunity of assisting and cooperating with others. From roundhouse machinist to the chief mechanical officer, his keen observations and



Norfolk & Western Picnic, 1924

Top row, left to right: G. O. Floyd, pipefitter; S. P. Seifert, superintendent car department; J. O. Looney, general air brake inspector—*Middle row:* R. G. Henley, assistant to superintendent motive power; Alexander Kearney, superintendent motive power; P. W. Crouch, boilermaker—*Bottom row:* J. J. Barry, general master mechanic; A. J. Weaver, machinist; A. W. Lescure, moulder.

deliberate conclusions have resulted in many outstanding solutions to difficult and troublesome problems. Being offered with a completely unassuming manner, they were always welcomed.

A Record of Progress

In a broad way, what has taken place in the mechanical department on the Norfolk & Western while Mr. Henley has been in charge? It so happens that the gross earnings, net earnings and gross ton-miles for the year when he took charge, 1928, and for the year 1940, do not differ very greatly. Moreover, 1940 does not reflect the present abnormal war conditions.

The accompanying table, which makes a comparison of locomotive and car statistics for these two years, reflects what has been accomplished by the larger, better designed locomotives and their more intensive utilization, the improved design of freight cars, and the more adequate facilities and methods for the maintenance and repair of cars and locomotives. It will be noted that the dependability of the locomotives has increased, as shown by the smaller number of failures, the increased miles per failure, and the lower maintenance cost per million tractive power pound-miles. Likewise, the dependability of freight cars has improved, as demonstrated by the increase in freight car-miles per break-in-two, and by the marked increase in the freight car-miles per car set off because of hot boxes.

Between the years 1924, when Mr. Henley came to Roanoke as assistant to the superintendent motive power, and 1932, which includes four years of his administration as the head of the department, the shops at Roanoke, Va., were rebuilt and equipped with modern machine tools and facilities. In line, also, with practices on the more progressive railroads, there was a marked tendency to centralize the maintenance and repair operations in both the car and locomotive departments and to rehabilitate or modernize the engine terminals in such a way as to insure a more effective utilization of the motive power. The objective has been to keep the power out on the road, earning dividends. To this end special auxiliary servicing arrangements have been set up to increase the availability of the power. Some of the modern road locomotives make 12,000 miles a month and frequently go 5,000 miles between cleaning of fires.

Mr. Henley's ability as an organizer was reflected in the improved supervision and discipline in the department. His business ability was indicated in the more economical handling of the budgets, as well as a better control over material balances and closer co-ordination between the stores and mechanical organizations.

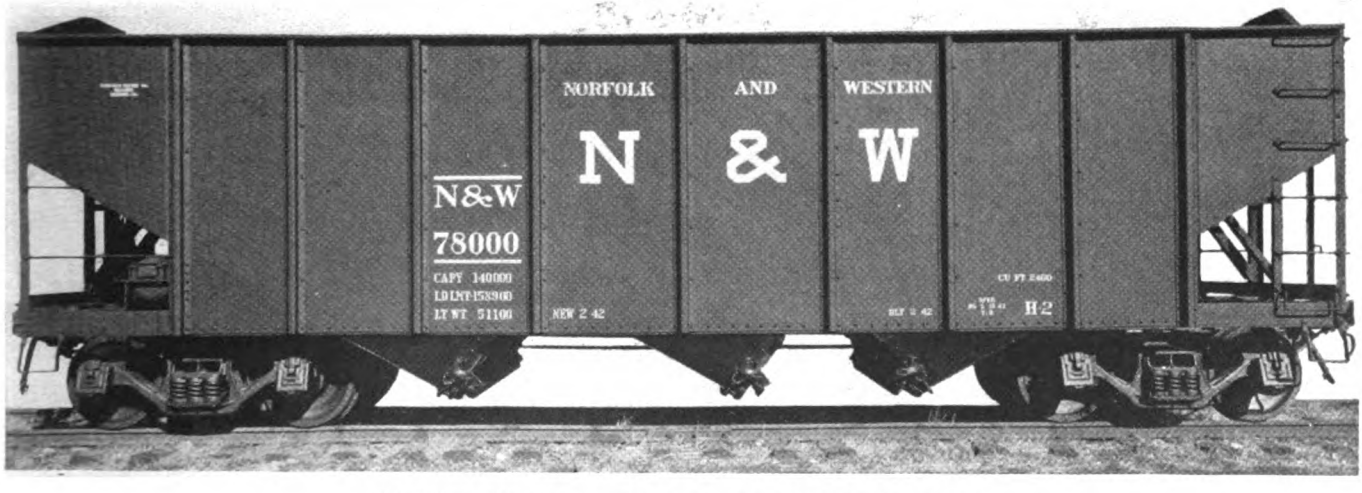
Designs and Builds Locomotives

The Norfolk & Western organization has a good bit of family spirit about it. Its officers have a strong sense of responsibility for the welfare of the employees and everything possible has been done to stabilize employment, particularly during the long continued depression of the 30's; to this end it has constructed 85 new locomotives in its Roanoke shops since 1930.

These locomotives are the most modern type, being carefully designed under Mr. Henley's direction, not only to suit the peculiar operating conditions on the Norfolk & Western, but also with a view to the most efficient operation, the greatest possible availability, and low cost of maintenance. Their operation is followed critically and closely, day by day, with a view to perfecting the designs as conditions may seem to warrant. An example of Mr. Henley's foresight and courage is the fact that the N. & W. leads all American railroads in the number of locomotive driving axles equipped with anti-friction bearings. The locomotives also have cast steel bed frames and extended mechanical lubrication.

Mr. Henley's favorite is the Class J, type 4-8-4 streamlined locomotive, five of which have been placed in service during the past two years. In addition to roller bearings on the engine trucks, driving journals, trailing and tender truck axles, these locomotives have lightweight rods and reciprocating parts equipped with roller bearings in the wrist and crank pins. They have a tractive force of 73,300 lb., a boiler pressure of 275 lb., and the weight of the engine in working order is 494,000 lb. The mechanical department is particularly proud of the artistic streamline design, the product of its own staff.

Another type of locomotive, which rates high in Mr. Henley's affection, is the Class A single-expansion, articulated 2-6-6-4 type, ten of which were constructed at Roanoke in 1936 and 1937. This was the first class of locomotives to be fully equipped with roller bearings. It was subjected to thorough dynamometer tests, which showed that it can maintain a maximum sustained horsepower at the drawbar of 6,300 at 45 m. p. h. According to a statement in the *Railway Mechanical Engineer* of October, 1936, in which these locomotives were de-



Norfolk & Western's most recent design of 70-ton hopper car

scribed, "this is believed to be the highest horsepower on record for a steam locomotive in America, and probably in the world." The maximum rate of evaporation recorded was 116,055 lb. of water per hour, or approximately 14,000 gal. The maximum sustained combustion rate was seven tons of coal per hour, or at the rate of 115 lb. per sq. ft. of grate area per hour. In dynamometer car road tests this locomotive handled on comparatively level tangent track a 7,500-ton train, maintaining a speed in excess of 60 m. p. h. In daily slow freight service, on a district of comparatively level track, these locomotives are regularly handling 13,000-ton trains, and on a district with .32 per cent ruling grade they are handling 11,000 tons.

Comparison of Locomotive and Car Data — Norfolk & Western Railway — 1928 and 1940

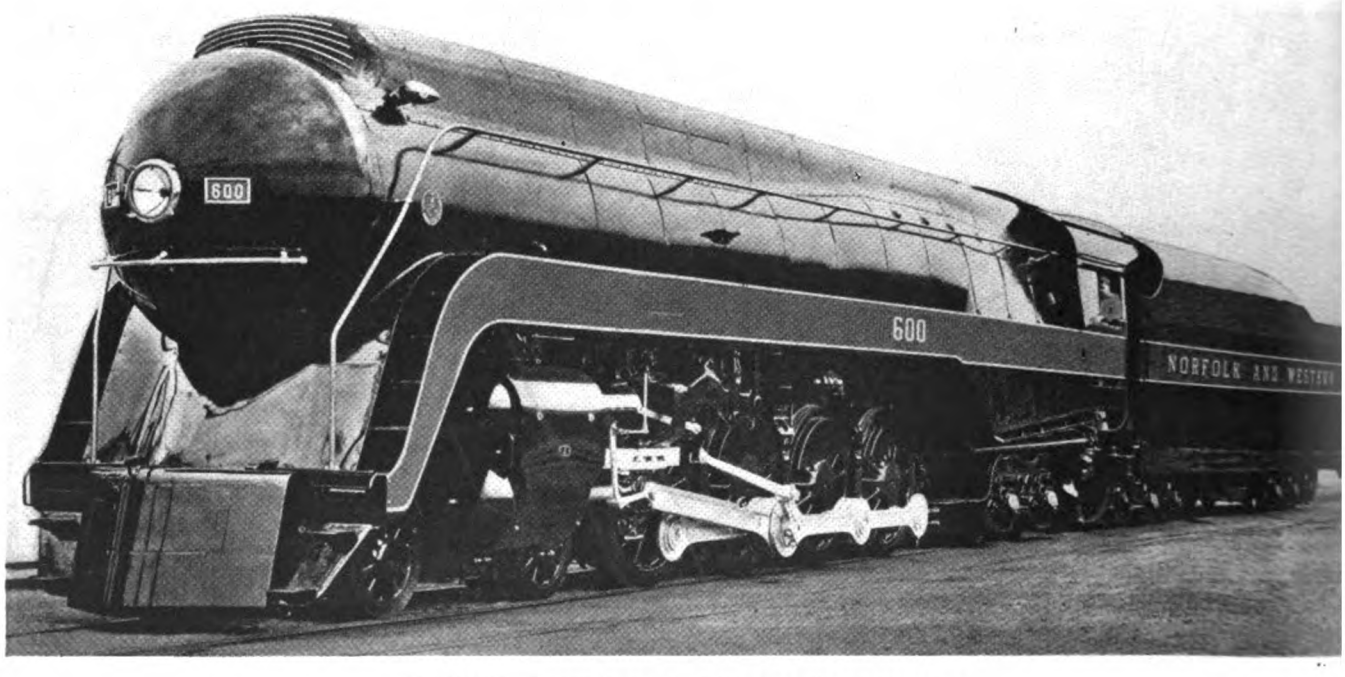
	1928	1940	Change per cent (Increase +; decrease −)
Gross earnings	$106,947,111	$105,228,621	− 1.61
Net earnings	30,727,043	31,383,976	+ 2.14
Gross ton-miles (thousands) excluding loco. and tender	30,048,502	30,178,450	+ 0.43
Number locos. owned	867	579	− 32.0
Gross ton-miles per freight train-mile, excluding locomotives and tenders	3,047	3,756	+ 23.0
Average speed, train-miles per train-hour (freight)	13.6	15.4	+ 13.0
Gross ton-miles per train-hour (freight—excluding locomotives and tenders)	41,357	57,984	+ 40.0
Pounds of coal per 1,000 gross ton-miles (including locomotives and tender road locomotives)	144	99.1	− 31.0
Number loco. failures	446	199	− 55.0
Miles per failure	46,373	77,929	+ 68.0
Cost of loco. repairs per million tractive force pound-miles, dollars (steam locos.)	$6.57	$4.99	− 24.0
Number freight cars owned	47,235	56,004	+ 19.0
Number freight car-miles per break-in-two	420,071	1,032,550	+145.0
Number freight car-miles per car set off account of hot boxes	121,152	1,234,659	+920.0

To indicate the type of engineering that is characteristic of the Norfolk & Western motive power and the extreme care that is taken to insure a high grade of precision, two facts may be cited. When drawings of the applications of the roller bearings to the locomotive main and side rods, including crossheads, were submitted to Mr. Henley by the manufacturer, attention was directed to the fact that all of the dimensions were expressed in thousandths of an inch. His comment, which is characteristic of the man and his work, was, "We like that quality of work; send us more of it." The second illustration is the fact that a series of forging dies has been developed at the Roanoke shops for main and side rods, which insure that the grain flow is continuous throughout the length of the top and bottom flanges of the rods and around the rod ends. This reduces the amount of machining to low limits and maintains a high degree of grain refinement in the finished rods. It is said that this is the only railroad shop so equipped.

Coal Cars

It is not surprising that on a coal carrying road in the Pocahontas region special attention should be given to hopper coal cars. Mr. Henley's associates refer to this equipment as one of his hobbies. Several years ago three men were detailed for a period of six months to study the hopper coal cars from the standpoint of the shippers and all those who had to do with their operation from the time of loading to their dumping into the colliers at Lamberts Point. This resulted in a rather distinct departure from the conventional design of such cars.

The number of rivets was materially reduced by the substitution of welded for riveted joints and by increasing the rivet spacing at certain prescribed locations. Fifty-one feet of welding was used and the number of joints was minimized by replacing multiple plates with single plates. The number of parts was further reduced by substituting commercial rolled sections for built-up construction and the life of the body plates was equalized by making the end and floor plates thicker than the side plates. As a result, a car was produced with the minimum light weight for single brakes. The cost of con-



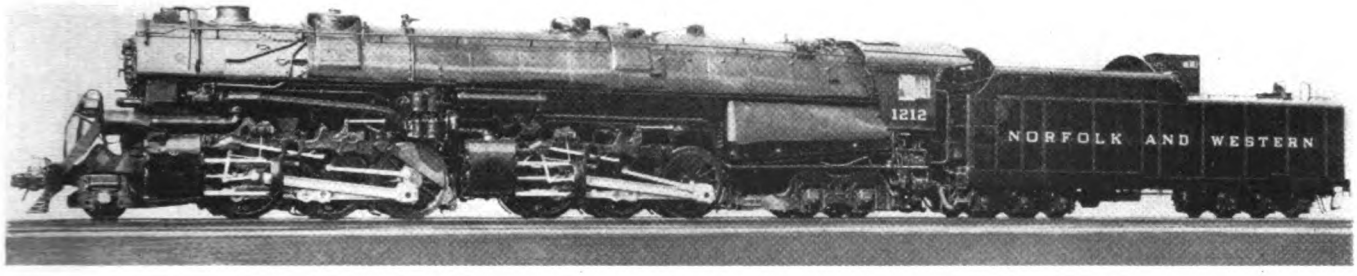
Mr. Henley is specially proud of this streamlined locomotive

struction and maintenance was also materially reduced. It is anticipated that with the use of copper bearing steel for the body plates it will have a life of 20 years, without shopping for heavy repairs. Until Pearl Harbor the Norfolk & Western had built 12,500 of these cars and car builders for other railroads 10,100.

A still later development is a 70-ton hopper car, which not only embodies the improvements built into the 50-ton cars, but includes further simplifications which reduced

repairing triple valves in the air brake department were provided with stools. Mr. Henley explained that these older men grew weary standing on their feet, and that since the work permitted, it seemed only right that they be furnished with stools to sit upon. Incidentally, this thoughtfulness paid dividends in increased output.

It is not surprising to learn that safety is emphasized in the mechanical department. The Norfolk & Western stands high among the Class I railroads for its safety



This single-expansion articulated 2-6-6-4 locomotive is used in freight and passenger service and is fully equipped with roller bearings—It weighs 570,000 lb. in working order and has a tractive force of 114,000 lb.—The wheel base of the engine and tender is 108 ft. 7¼ in. —It can maintain a maximum sustained horsepower of 6,300 at 45 m. p. h. and is believed to be the most powerful steam locomotive in America

the fabrication costs and the scrap loss. The amount of welding was increased to 267 ft. when using plates 72 in. wide and less. By actual scale weight, only 205 lb. of cuttings remained after the construction of one of these car bodies. The cost of construction and maintenance is reported to be well below that of cars of conventional designs. Fifteen hundred cars have been built to this design and the bodies of approximately 14,000 other 70-ton cars will be converted to the new design, as body plate renewal becomes necessary.

Leadership

Mr. Henley is soft-spoken and dislikes publicity and ostentation. He is quiet and unassuming and yet he has rare talent as an educator and has the knack of getting things done by suggestion, rather than by giving specific orders. He leads men, rather than drives them. He rarely gets angry, rarely talks above the conventional tone of voice, but if the occasion does demand it, he is capable of handing out a stinging rebuke. As one of the men who have been closely associated with him for many years puts it, "He is one of the most determined men that I have ever known; once he sets his mind on anything it is as good as done. No matter what the task, large or small, he always follows through and all his lieutenants are trained in the same manner. He has no patience with a man who cannot carry on an undertaking to a successful conclusion."

As another associate expresses it, "He deals with facts and carefully considers a problem from every possible angle. When a decision is arrived at, it is without bias or prejudice. Many large organizations suffer because of the practice of 'buck passing.' This has been thoroughly eradicated in the mechanical department of the N. & W."

While he requires good, honest, efficient service, he is considerate of the feelings and welfare of his associates. In going through the shop, for instance, he noticed that men engaged in a certain type of work got their feet and the lower part of their trousers wet. He immediately ordered that they be furnished with rubber boots.

An officer from another railroad, going through the shop, noticed that the men engaged in overhauling and

record. For each of the years 1926, 1938, and 1940 it was awarded the Edward H. Harriman Memorial Gold Medal for its outstanding safety performance, and for the year 1941 it was given first place in its group by the National Safety Council.

Training Employees

The apprentices receive their shop training under close supervision of the supervisor of training and the foremen. Complete and accurate records of their progress are kept. Special care is taken to see that they receive a well rounded-out experience and the size of the railroad is not so great but that the chief can follow their individual progress. Those showing special aptitude are given experience in the blue print department and drawing room.

College graduates are encouraged to take special apprentice courses. As a result, a supply of enthusiastic and ambitious young men is maintained for promotion to supervisory positions, not only in the mechanical department, but in the operating department as well.

Hobbies

Mr. Henley's hobby is railroading. He is first, last and always a railroad man. He is a lover of books, an ardent reader and deep thinker. This undoubtedly accounts for his excellent command of English and his extensive vocabulary. It is reported that he is also a good cook and that he aspires to be a fisherman, if and when he can get the time. Queries as to his golf record are quietly ignored.

Summing Up

The story has been told—told by thirty-five friends and associates who co-operated in supplying the information. There is much more that could be said, however, if space permitted.

It can possibly best be summed up in the words of an executive of the N. & W., when his co-operation was requested. "Go ahead," he said. "Here is a man who has worked his way from a roundhouse mechanic to the very top of the mechanical department. It should be a real help and inspiration to the ambitious young men in railroad service."

Braking High-Speed Trains*

By C. D. Stewart†

Discussion of a recent development in brake equipment designed to stop trains in shorter distances and control wheel slipping

THE stress of war brings technological improvements in months that under less strenuous circumstances take years to achieve. And because modern warfare is so highly mechanized, the nature of many of these improvements is of necessity mechanical. Furthermore, since this particular war is global in character, transportation is one of the most vital services. Therefore, as we would expect, the greatest improvements are being made in the newer means of transportation. This newer means, of course, being air-borne transportation.

It is most fitting, therefore, that those of us who are interested in rail transport take stock in order that when peace comes we will not be unprepared for the adjustment that must follow. It seems to me that it would be worthwhile to analyze briefly what place other means of transportation may have in our post war world so that we may be better prepared to say what changes or improvements may be advisable and desirable in rail transport.

Of these other means, air-borne transport comes first to mind because it has speed for its major appeal. Next in importance is highway transport because under our present state and national public highway policy, low direct cost is possible. Furthermore, undoubtedly the great Pennsylvania Turnpike will be used as a model for many additional miles of new construction. Therefore, highway transportation will have additional new advantages. In these two competitive transportation systems, we have two basic reasons for keen competition, namely, speed in the one, low cost in the other.

Even if we were so minded, there is little that anyone could do to make these two modern forms of transportation less appealing, but on the other hand, the situation is not as hopeless as some people would have us believe. Either because of wishful thinking or because of lack of full information, there are some who predict the gradual ending of the railways' usefulness. This type of observation has advanced to the point that numerous men in high positions have attempted to draw a more reasonable picture of the future of transportation.

W. A. Patterson, president United Air Lines, before meeting of the Railroad Securities Committee of the Investment Bankers' Association of America, stated:

"The future of the airplane in commerce is indeed great, but it appears that this future will be realized without serious embarrassment to the steamship lines or to the railroads. The volume of domestic air cargo could increase one hundredfold and yet capture only one-tenth of one per cent of the freight-ton miles now carried by the American railroads. Our economy demands the services of all the various types of transport media, each fulfilling the requirements peculiar to its own inherent characteristics. It would appear that the airplane can not supplant, but instead it will supplement the railroads."

It is well and good that the railroads be considered an institution of public necessity but that does not of itself insure sufficient business to make operations profitable. The other agencies will attempt to increase their former share of goods for haul and they will have striking advantages with the improvements that this war is bringing into being. Therefore, it is advisable to consider what improvements are available to the railroads that will put them in a better competitive position. Before referring specifically to these, I would like to quote from one more authority who states the railroad's case most clearly:

According to Carleton W. Meyer, assistant to president, New York Central: "The capacity of the cargo plane is small, but *ton miles* rather than *tons* measure the productivity of a transportation machine. The five-ton cargo airplane traveling at 150 m.p.h. produces 750 ton miles per hour, the same as a 45-ton railroad car moving at the average railroad freight train speed of 16.5 m.p.h. The available facts indicate that railroad merchandise freight service after the war will have to be operated at speeds comparable to present passenger train speeds if it is to handle a satisfactory volume of business."

Improvements in Brake Control

I should like to discuss one new and ingenious means by which the movement of important traffic can be materially expedited. This embraces a recent advancement in the art of brake control which has for its objectives shorter stopping distance with provision for the control of slipping wheels when sub-normal rail adhesion is encountered. Developed for the streamlined passenger trains, it is giving highly successful performance on these trains from coast to coast. And now with thought being given to stepping up l.c.l. freight and express service to substantially passenger train schedules with cars and trucks of suitable design for this operation, the improved control of the braking becomes of equal importance.

One of the principal limiting factors in establishing maximum braking force has been the minimum rail adhesion that might be encountered under some local adverse rail conditions. The relatively low emergency braking force commonly used for many years was established through experience with the form of brake control then available, which as you know had only one brake cylinder pressure value throughout the stop. No wheel sliding resulted, except under exceedingly poor rail conditions because the retarding force was based on a rail adhesion value much below the average encountered. Obviously, therefore, if a braking force is employed that is more in keeping with the normal rail adhesion, the stopping distances may be materially shortened. But to avoid wheel sliding with this higher braking force, it is desirable to add means whereby the braking force may momentarily be reduced automatically when subnormal rail adhesion is

* Abstract of a paper presented before the February meeting of the Railway Club of Pittsburgh.

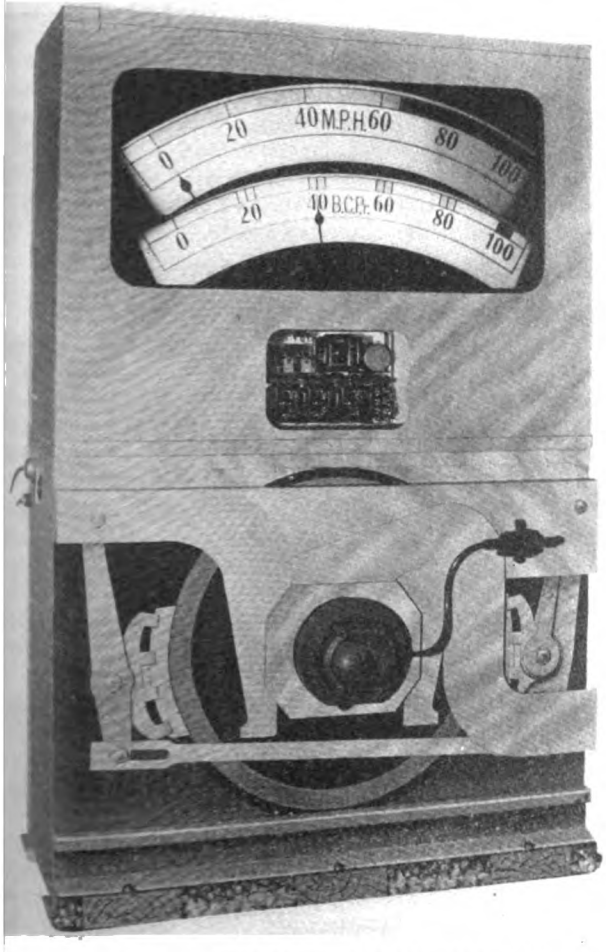
† Chief engineer, Westinghouse Air Brake Company.

encountered temporarily, and also this same means may be employed to pilot the functioning of apparatus that steps down the braking force as the speed reduces. Thus it is possible to use the brake cylinder pressures that are correct for the entire speed range rather than a constant pressure that must of necessity be a compromise. That is, not too high for the low-speed zone where shoe friction is high, and not high enough for the high-speed zone where shoe friction is low. The wheel-slip control and speed pressure regulator perform these functions.

In view of the fact that the coefficient of friction between the metal shoe and the car wheel increases with the reduction in speed, it follows that theoretically the brake-cylinder pressure should be regulated continuously downward to counteract this phenomenon. Actually it is not necessary to have the regulating device perform so precisely. Actual road tests show that it is sufficient to regulate the brake cylinder pressure from the maximum to the minimum in four steps and that a very close approximation to the ideal is secured thereby.

How Regulation of Pressure Is Achieved

The means by which this desirable function is accomplished consists, first, of a small direct current generating device that develops current in proportion to speed; second, of three electric relays, each one of which is tuned



Demonstrating device employed to illustrate the performance of the Decelostat wheel-slip and speed governor controls

to a different predetermined current that causes them to operate when a predetermined speed is attained; and, finally, of a brake-cylinder pressure-regulating device, termed a differential relay.

The maximum braking ratio with speed-pressure control may be raised from the conventional of 150 per cent to 250 per cent of the car weight. This braking ratio prevails from top speed for the train down to 65 m.p.h. At approximately 65 m.p.h. the first speed sensitive detector relay functions and the electro-pneumatic relay initiates a reduction in brake-cylinder pressure. If the stop is being made at the maximum contemplated rate, such as prevails with an emergency application, the first brake-cylinder pressure reduction is completed about the time the train speed is reduced to 40 m.p.h. At this point the second speed-sensitive relay functions and the differential relay now initiates the second brake cylinder pressure reduction.

The braking ratio during this time has been reduced from 250 per cent to 200 per cent, and then from 200 per cent to 150 per cent. At 20 m.p.h. the third and last speed-sensitive relay functions and the differential relay initiates the third brake cylinder pressure reduction. The braking ratio is thereby reduced to 100 per cent and this value prevails to the stop.

By the same means the brake-cylinder pressure for stops from intermediate speeds is limited to the value that is suitable for the particular speed at which the application is initiated.

One striking example of the advantage of this plan of brake-cylinder pressure regulation is on the occasion of an emergency brake application by the conductor's valve at low speed, such as when starting out of a station.

There are two plans for applying speed pressure control, both of which are in use today. For trains which remain permanently coupled, two centralized speed-control units regulate the entire train. For trains that may have their consist altered, individual speed control units are applied to each car. With the first plan, control wires are run from the centralized units throughout the train, and with the second plan, each car is a self-contained unit in itself. The second plan is obviously more flexible and the full benefit of the modern and powerful brake is always available in trains of any consist. Large returns are immediately available from each modern brake equipment that is added to existing trains in that the stopping distance is shortened in direct proportion to the increase in the number of such equipments in any train.

For wheel-slip protection the speed-control generator is used also for the protection of its particular axle and the same type of electric generator is added to each of the other axles of the train. Two of the electric relays used for speed-governor control are likewise given a dual function to perform, and other electric relays of similar appearance and size, but different in function, are added to the relay panel. As you will recall, we stated that the electric relays used for speed-pressure control are constructed so as to be responsive to a certain *speed,* having in mind that speed and voltage values are synonymous. The electric relays used for wheel-slip protection on the other hand are so constructed as to be responsive to a certain rate of *change in speed.* There is no difficulty whatever in having these relays designed to ignore the rates of change in speed that are incident to normal stopping of the train and yet infallibly recognize rates of change in speed incident to a wheel commencing to slip.

For example, the normal retardation rate of a train is about two and one-half miles per hour per second, and it may reach under unusual conditions five or perhaps five and one-half miles per hour per second. On the other hand, a wheel slipping to a stop may reach a rate of deceleration of 100 m.p.h. per second. The latitude this

(*Continued on page 262*)

The Steam Locomotive

By Wm. T. Hoecker

A study of the book of that title by Ralph P. Johnson

DURING the latter part of 1942, a book entitled "The Steam Locomotive," written by Ralph P. Johnson, chief engineer of the Baldwin Locomotive Works, was published by the Simmons-Boardman Publishing Corporation. This comprehensive volume fills a definite gap which has existed in the literature of locomotive engineering for many years. In fact, it is no exaggeration to say that no comparable American book has appeared since the publication of the late G. R. Henderson's "Locomotive Operation," nearly 40 years ago. The railway engineering profession in America has been graced by many men who should have been quite capable of producing a similar work, but they seem to have lacked either the time or the inclination to do so. A European engineer of the first rank seldom considers his life's work complete until he has produced at least one book dealing with the subject most familiar to him. That is why the technical literature of Europe is so much more extensive than our own and is continually kept up to date. It is to be hoped that the present book will not be Mr. Johnson's final effort, and that his excellent example will stimulate others to devote the time and labor required to bring our railway technical literature to a level corresponding to that of other countries.

What Is a Mallet?

Since everything connected with the steam locomotive has always been a source of interminable argument, it is perhaps unavoidable that a controversial statement should appear on the very first page of Mr. Johnson's book, where he asserts that American articulated locomotives with single-expansion cylinders should not be designated as Mallets. This has long been a favorite theme of certain spokesmen for the locomotive builders, who forget that Mallet's French patent of June 18, 1884, did not relate exclusively to the application of compound cylinders to articulated locomotives. Mallet also claimed "the invention of dividing them into two units acting on distinct groups of axles, without constraint of mutual parallelism, viz., one pair of cylinders acts upon two or three *fixed axles,* while the other pair acts upon the *axles mounted on a swiveling truck.*" The rigid attachment of the boiler to the rear engine frames is the distinctive feature of the Mallet articulated type; compound cylinders are not peculiar to the Mallet, as they have been employed on several other forms of articulated locomotives. Four-cylinder simple engines with running gear articulated on the Mallet principle were built in Russia as early as 1903. The two earliest North American designs appeared in 1911 and 1912; both of them are described in the 1912 edition of the "Locomotive Dictionary" as "Mallet Simple Articulated Locomotives." The designation of such engines merely as "single-expansion articulated" does not serve to distinguish them from several other types, such as the Beyer-Garratt and Kitson-Meyer, now in extensive use throughout the world.

The table of wheel arrangements on page 2 lists the 4-10-0 or "Mastodon" type, only one example of which has ever been constructed anywhere, so far as is known to the present writer. This locomotive was built at the Sacramento shops of the Central Pacific in 1883, and bore the name "El Gobernador." The celebrated locomotive named "Mastodon" was also built at Sacramento one year earlier; it was of the 4-8-0 type. How the name became attached to the 4-10-0 type, and why the misnomer has persisted so long, one can only surmise.

In dealing with the subject of front ends generally, some reference might have been made to the extensive report of the A. A. R. Committee on Locomotive Construction at the 1936 convention. The author appears to entertain a very favorable opinion of the star type exhaust nozzle, which is a modified form of an old device. Speaking before the Institution of Mechanical Engineers in London, on June 28, 1900, Prof. L. P. Breckenridge gave some details of an exhaust nozzle with eight radial trapezoidal ports, which had been developed by one of his students at the University of Illinois a short time before, and was then in use on more than 50 locomotives of the Illinois Central. This form of exhaust orifice seems to have been abandoned later, as it was not among the nozzles tested at the University some ten years ago.

Ashpan Dampers—a Refinement?

Ashpan dampers, practically a standard detail in European practice, are dismissed by the author, ostensibly because they "offer construction difficulties." Is it perhaps possible that our overworked enginemen might neglect a refinement of this nature? The provision of ashpan dampers would appear to be a better means of regulating the air supply to the fuel bed than the recent practice of restricting the air passages through the grates to a minimum.

The very worst water listed in Table VII, on page 61, is credited to the city of Galveston, Texas. In justice to this city, it should be noted that the two analyses given by Mr. Johnson probably refer to water taken from experimental wells drilled on Galveston Island many years ago. Water for railroad use has long been obtained from the municipal water supply, which is described in a recent publication of the Corps of Engineers, U. S. Army, as follows: "This water is good for boiler purposes, as well as for household or drinking purposes. It forms very little scale and is not hard on metal."

The chapters on evaporation, tractive force, horsepower and resistance are of prime interest to all those who, professionally or otherwise, are concerned with forecasting the probable performance of locomotives. Fair warning is given the reader that it is not possible to devise a formula for horsepower rating "which will be simple and at the same time correctly account for the many variables present." The scarcity of detailed data relating to the performance of locomotives of strictly modern dimensions and proportions has undoubtedly compelled the author to rely upon some material of questionable present

value. Except tor the addition of figures purporting to represent the evaporation from 3¼-in. and 3½-in. flues, Table XIV has been taken bodily from F. J. Cole's locomotive ratios of 30 years ago. Estimating the evaporative capacity of a locomotive boiler from the values given in Table XIV has the admitted advantage of being a relatively simple process, but whether these evaporation values are applicable to the boilers of today is a debatable question, to say the least. A more scientific method of estimating boiler capacity was suggested by Lawford H. Fry some years ago. It is to be regretted that lack of sufficient experimental data has retarded the general application of Mr. Fry's method.

Firebox Evaporation

The author's assertion that about 40 per cent of the total evaporation of a boiler takes place around the firebox is an interesting confirmation of the results of the classic experiments conducted on the Northern Railway of France in the '70s, with a small boiler divided into five sections. Because of the absence of normal circulation in the boiler, too much importance should not be attached to the results of such tests. Exactly what proportion of the total evaporation must be credited to the firebox and to the tubes at various rates of combustion will probably always be a matter for conjecture.

Steam rates per i.hp.-hour depend very largely upon the pressure and temperature of the steam delivered to the cylinders. As the author makes clear, determining the probable average degree of superheat attainable in a locomotive boiler involves much more than the ratio of small to large tubes. Short-tube boilers with a ratio of seven frequently provide more than 250 deg. of superheat, while long-tube boilers with a ratio of three have sometimes given disappointingly low steam temperatures. The table of estimated degrees of superheat on pages 149 and 165 should therefore only be looked upon as a rough approximation.

On page 102, Mr. Johnson states that "at a given rate of combustion, the temperature of the steam from the superheater is not affected by the use of a feed-water heater." This statement would appear to require some further elucidation to render it more convincing. Given two boilers of identical design and in the same state of repair, both fired in the same manner with the same quantity and quality of fuel, but fed with water at 50 deg. F. and 200 deg. F., respectively, it is clear that the second boiler will evaporate the greater quantity of water. As the same amount of heat is theoretically available for superheating in both instances, it is difficult to see how the same steam temperatures can be attained. Mr. Johnson's statement would imply that the presence of the feed water heater is responsible for some increase in the efficiency of the superheater.

The author stands on solid ground in his conservative estimate of the saving to be expected from exhaust-steam injectors. Though the advertisements of the original manufacturers have for many years claimed an economy of 10 per cent, some of the most eminent English engineers have said quite plainly that they were unable to obtain any such figure in regular service; some of them put the year-round saving at about five per cent.

The steam rates for maximum i.hp. output tabulated on page 154 are apparently based upon the amount of steam actually delivered to the cylinders, as the author quotes a rate of 19.7 lb. for steam at 200 lb. pressure and 200 deg. of superheat, while F. J. Cole assumed a rate of 20.8 lb. under the same conditions, the latter figure including steam for auxiliaries. Before Table XXIV can be employed in calculating the potential horsepower capacity of a locomotive, some allowance must be made for the numerous auxiliaries without which successful operation of the modern locomotive would be virtually impossible. This allowance can be made either by increasing the assumed rate of steam consumption or by reducing the rated evaporation of the boiler. In estimating the rate of steam consumption, it is wisest to err on the side of conservatism. It is true that a steam rate of 15 lb. per i.hp.-hour has been achieved in certain road tests at maximum capacity, but the author himself casts doubt on the accuracy of indicator cards taken during road tests. When it is remembered that the apparatus and methods used in the most modern testing plant in the world only insure a degree of accuracy within five per cent, the necessity for caution in applying the results of road tests to problems of design is apparent.

Tractive Force Formula

In discussing the standard formula for rated tractive force, or maximum theoretical starting effort of two-cylinder single-expansion engines, Mr. Johnson states that the tractive force obtained from this formula is "therefore cylinder tractive effort, and not at the rim of the drivers." It will be admitted that the figures obtained from the formula are more conveniently used for certain purposes when regarded in the above light, but, strictly speaking, there is no such thing as "cylinder tractive effort." The maximum tractive force of a locomotive is exerted at the points of contact between driving wheels and rails, and the formula $\frac{C^2 \times S \times P}{D}$ evinces on its face that it was devised for the purpose of calculating tractive force at the circumference of the drivers. The exact figures are not at present available, but the writer's recollection is that the factor .85P was based upon a cylinder mean effective pressure equal to 92 per cent of the boiler pressure, in conjunction with a machine efficiency of 92 per cent. These percentages were established during the era of saturated steam locomotives with oil-lubricated bearings. No doubt they would require revision downward to take care of the greater fall in pressure between boiler and cylinders of the average superheater locomotive, and the lower machine efficiency of grease-lubricated engines, so probably it is better to proceed upon the assumption that the mean effective pressure in the cylinders of modern locomotives does not exceed .85P. It may be of interest to note that a chart very closely resembling Fig. 26 on page 146 was featured in at least one publication of The Baldwin Locomotive Works. The legend at the left of this chart reads as follows: "Per Cent of Rated Tractive Force *at rim of driving wheels.*" Such contradictory data can easily lead to confusion.

The author's treatment of train resistance is concise, yet thorough, up to the point where he deals with the resistance of steam locomotives. When it is recalled that as much as 50 per cent of the power developed in the locomotive cylinders may be absorbed in keeping the engine and tender in motion at high speeds, or on heavy grades, an accurate estimate of engine and tender resistance becomes a matter of supreme importance in designing locomotives. Most authorities pass over this subject as quickly and briefly as possible, and Mr. Johnson is no exception to the rule. In the space of half a page, one formula, applicable to all kinds of steam locomotives, whether equipped with roller or plain bearings, oil or grease lubrication, is presented. Example 2 on pages 197-8 in-

dicates clearly enough that the user of this formula must be prepared to exercise his own judgment. In the example, the engine is developing 77 per cent of its rated tractive force, and running with a mechanical efficiency of nearly 93 per cent. This is slightly better than the machine efficiency shown by most modern locomotives on stationary testing plants, where the truck wheels are at rest, and there is no air resistance. It should also be observed that gradient and curve resistance of the engine and tender have been omitted from consideration in computing the tonnage rating on page 198, thus introducing a serious error into the final result.

Another error, probably due this time to a printer's omission, occurs on page 207, where it is stated that 5730×3.1416 is equal to 360×100. This should be $5730 \times 2 \times 3.1416 = 360 \times 100$.

The author correctly draws attention to the desirability of long valve travel, but does not say why maximum travels of from 9 in. to 10 in., which were common several years ago, appear to have gone out of fashion. Table XXXIX differs very little from the one published on page 122 of the American Locomotive Company's Handbook of 26 years ago. The greatest valve travel listed in both tables is 7 in., but The Baldwin Locomotive Works has recently built engines in which this figure is exceeded, without resorting to abnormal forms and proportions of the valve motion.

Dynamometer Car vs. Road Tests

Two chapters on locomotive testing and dynamometer cars contain detailed information and drawings of a nature rarely found in similar books in any language. Though he admits that they are "inherently less accurate than laboratory tests," the author is a firm believer in the value of road tests. It has been truly said that locomotive testing plants are intended to supplement—not to displace—dynamometer cars; the one is the indispensable complement to the other. In 1933, when the French National Railways built a testing plant of 7,200 hp. capacity at Vitry-sur-Seine, four 70-ft. all-steel dynamometer cars were constructed at the same time.

The last seven chapters of the book, dealing largely with the economics of locomotive operation, deserve the careful study of operating department executives, even though a few of them may have some slight difficulty in grasping the mathematical formulae with which the chapters are interspersed. The author's treatment of the Diesel versus steam question is of especial value because of its relatively unbiased nature. In this respect, it is in refreshing contrast to the reams of propaganda issued during recent years by the supporters of both forms of motive power. In this paper war, both camps have overlooked the simple fact that, so far as the future is concerned, the main question is whether the railway or the highway shall be the backbone of our transportation system. If the railway is to continue in its predominant position, the motive power of the future must be chosen *in every case* on the basis of careful analysis of financial and operating problems. Mr. Johnson has assembled an array of facts and figures which should simplify the study of these essentially complicated problems to a great extent.

Every man occupied with or interested in the design and operation of railway locomotives should possess an up-to-date working library. "The Steam Locomotive" is a mine of information that will occupy a useful place in that library. Despite a few minor defects and errors, unavoidable in first editions, this book will certainly rank as a standard reference work on its subject.

Locomotive Steam Distribution

(*Continued from page 251*)

limits the effectiveness when cut-offs shorter than 25 per cent are attempted. The harmful effects of too much pre-admission and high compression are recognized and there is a growing tendency to block off quadrants, making it impossible to operate at cut-offs shorter than 2 per cent.

Cylinder Clearance

Cylinder clearance has an important effect upon expansion and compression, as by it an apparent cut-off of a known ratio creates, in reality, a considerably longer actual cut-off.

Straight and direct ports to the cylinder reduce the clearance, but it is impossible to design ports of adequate passage area to give at the best less than 8 or 9 per cent cylinder clearance volume. From the foregoing, we have seen that the wasteful effect of cylinder clearance can be offset to a large extent by compression. But this excess volume of steam has to pass the exhaust nozzle.

A little study of the matter will show that cylinder clearance is a speed limiting factor for the reason that at high piston speeds this excess volume of steam necessarily has to pass the exhaust nozzle—thus increasing the back pressure on the pistons.

Braking High-Speed Trains

(*Continued from page 259*)

situation affords is so broad that we are free to select almost any rate we care to employ with our wheel-slip control relay. We have chosen the rate of 10 m.p.h. per sec., first, because it provides sufficient margin above the maximum train retardation rate to insure against unintentional functioning, and yet incipient wheel sliding is detected early enough to make possible the lowering of brake-cylinder pressure in time to avoid the wheel coming to a complete slide. In fact, we have taken graphic records of wheel retardation in actual road operation and have been fortunate enough to record graphically incipient wheel sliding, and in some cases the reaction of the wheel-slip controller was so prompt that it required careful analysis of the records to locate the change in the pattern produced by the wheel first slowing down and then resuming train speed.

Makes Maximum Brake Performance Possible

It may be asked if this anti-wheel-slip device, which we have termed Decelostat, will lengthen the stopping distance if it functions as a result of a wheel slipping, and particularly in high speeds. The answer is that it does not, as has been demonstrated by actual road tests. As a matter of fact, the stopping distance is shortened because a sliding wheel is not as effective in stopping a vehicle as one braked just under the point of wheel sliding. The ability materially to increase the braking effort in the manner in which we have described makes possible consistent maximum brake performance under all kinds of adverse conditions, equivalent to the best performance that otherwise is only possible under the most favorable rail conditions.

EDITORIALS

Nigger in the Woodpile

Our Roundtable discussions, inaugurated a few months ago, got off to an exceptionally good start and seem to be growing in popularity. In announcing and presenting the contributions we have been careful to keep our hands off, so far as attempting to steer the discussions is concerned. Their value rests in the fact that they come from practical men in the field, who are intimately associated with the various developments, and in many instances have decided opinions about them.

A minimum of editing has been done, in order not to detract from the contributors' thought and expression. Occasionally, however, we have wondered just how our readers would react to certain comments and statements. Indeed, we have been hopeful that some of these would be questioned in letters to the editor, which we could print and thus provoke further thought and discussion.

The contributions in the Roundtable on Hot Boxes, which will be found elsewhere in this number, would seem to afford excellent grounds on which to base a real, lively and constructive discussion. Do you agree with all of the statements that are made? If not, why not? Certainly there are one or two suggestions that should be questioned and a more thorough discussion of which might be of considerable practical value in giving our readers a better understanding of some of the fundamental principles of journal box lubrication.

An Empty Water Glass Requires Decisive Action

In a statement which appeared on page 83 of the February issue of this publication, John M. Hall, director, Bureau of Locomotive Inspection, called attention to the increases in boiler explosions which have been taking place since the last fiscal year of the Bureau closed on June 30, 1942. He called attention to seventeen such explosions which had occurred since last July 1 "which resulted in the death of 14 experienced enginemen, firemen, and trainmen and seriously injuring 46 others." Addressing himself particularly to enginemen and firemen, Mr. Hall urged on them the importance of being alert with respect to the water level in the locomotive boiler.

Since that time reports of twelve of the accidents to which he referred have become available. Six of the twelve illuminate the question of what takes place in the locomotive cab during the few minutes prior to the final catastrophe in locomotive boiler explosions—a question to which there is no answer in all too many cases. In these six instances the evidence indicates that the enginemen were aware that the water in the boiler was receding at a dangerous rate, or was already dangerously low. For considerable periods of time prior to the ultimate crown-sheet failures, the evidence shows that the men in the cab had been endeavoring to bring the water back into the glass, in some cases in the face of a succession of unexpected difficulties which consumed all too many of the precious minutes within which they had to take effective action to avoid disaster.

Why do these men persist in trying to restore the water level in the face of such extreme danger? At least two reasons may be suggested. A locomotive boiler which can evaporate from 70,000 to 80,000 lb. of water an hour will have between 500 and 600 gallons of water between the bottom of the water glass and the top of the crown sheet at its highest point. This is between 4,000 and 5,000 lb. of water. If the feedwater supply has failed completely, the water between the bottom of the water glass and the top of the crown sheet will be evaporated in from four to five minutes if the boiler is working at full capacity, or in eight to ten minutes if working at half capacity. Are enginemen generally aware of this extremely narrow margin of time within which they can be sure of safety after the water first disappears from the bottom of the glass?

Consideration should also be given to the fact that in their day-by-day experience in train operation constant pressure is exerted on enginemen to avoid delays. On the other hand, experiences with low water are infrequent and men are not under constant pressure with respect to the steps which should be taken when water cannot be kept in the water glass. In the absence of positive evidence that there is no time for further efforts to restore the water in the boiler, habit prevents a decision to pull the fire, by which the engineman makes himself responsible for an engine failure.

How many railroads have formulated definite rules of action embodying safe procedure to be followed when low-water emergencies present themselves? Probably no one will disagree with the statement that such rules should be established. But that is only the first step in dealing with this situation. The real problem is how to enforce these rules once they are established. The customary method of disciplining men for infraction of rules is seldom available after a crown-sheet failure. But there must be some means of bringing them regularly to the attention of the men who are expected to

observe them promptly when the emergency requires. The very lack of opportunity for acquiring familiarity by observance calls for the use of bulletins, the sending out of periodic reminders, or periodic examinations by the road foreman of engines. The application of some such methods is essential if these employees are to act decisively in time to prevent disaster, when the emergency arises.

Nine Weeks—125,885 Defects

Compiled figures released by the Mechanical Division of the A. A. R. show a total of 125,885 defects reported by the American railroads during the first two months of this year which required setting tank cars out of trains for attention or repair. This figure represents a daily average of more than 2,100 cars and is an indicator of the intensive utilization being made of tank car equipment. More important, it points to the one class of equipment in which the danger of serious accidents with possible loss of life and certain property damage appears to be almost inherent.

A breakdown of the causes of these set-outs indicates that the great majority of them occurred in connection with car parts which are always potential sources of accidents. Hot and cut journals accounted for 6,203 of the total, brake rigging and brake beam defects for 17,548, defective and slid flat wheels for 26,394, truck defects, including springs and snubbers, for 18,137, draft gear and underframe defects for 19,481, a total in these classifications of 87,673 of the general total of 125,885. Most of the remainder were caused by inoperative air brakes, overdate brakes, and defects in piping or other parts of the air-brake system.

Surely the vigilance and attention to duty of the mechanical department employees, assisted often by those in the transportation department, is plainly evident in the figures given. The need for such vigilance will not lessen as heavy oil movements by railroad continue. Because of it the number of accidents to solid oil trains and to mixed trains in which tank cars are included has probably been held to a minimum when operating speeds, the demand for quick turn-arounds, and the condition of much of the equipment operating is considered.

It is dangerous, however, for mechanical and operating officers to close their eyes to the fact that the condition of tank car equipment is growing steadily worse despite the patch work repairs being made from time to time. The efforts of the Mechanical Division have been directed primarily to the application of snubbers to spring nests and the substitution of steel wheels in place of chilled-iron wheels. Both programs are progressing but, to date, only about 35 per cent of the cars have been equipped with snubbers. The number equipped with steel wheels is hardly large enough to reduce appreciably the possibilities of derailments.

It appears that the most important thing to be considered is that many of these cars are accumulating a total mileage far in excess of what they formerly accumulated each month and are doing it at speeds which are much greater than those for which much of the equipment was designed. Oil movement is vital to the war effort and speed in its movement is a necessity but oil trains spread out over the right-of-way, perhaps on fire, can not deliver their loads to shipping points for movement to any of the theaters of war. They can delay other vital movements for long periods while wreckage is cleared and roadbeds restored to serviceable condition. Such conditions can occur more frequently if the present excellent work is not continued or if adequate repairs are not given to all equipment in need of more than rip-track attention. There is an old saying that, "You can work a willing horse to death," and care must be taken that tank cars are not so treated.

The present cooperation between owners, railroads, the A. A. R. and interested government agencies will need to be continued, and even increased, if the volume of oil movement to the East is to meet all military and essential civilian demands. During the first two months of the year, 125,885 set-outs represented almost five per cent of the total cars, empty and loaded, handled. The figure indicates that there is no compromising with safety in handling tank cars but it is so high as to indicate that there is a tight situation which must not be allowed to get out of hand. Railroaders can be depended upon to do their part to see that it does not.

Cold-Cathode Fluorescent Lighting

Within the past five years the hot-cathode, low-voltage fluorescent lamp has revolutionized industrial and commercial lighting. Its invasion of the home has been less successful, probably because of its shape and its deficiency in the red end of the spectrum. The incandescent lamp is still in the ascendancy, but it can expect further inroads from both the fluorescent and the high-intensity mercury vapor and sodium-vapor lamps. The principal reason for this change is the high efficiency of the new light sources.

Very recently, a number of lighting installations have been made which employ the cold-cathode fluorescent lamp. This seems a little strange since one of the earliest electrical devices, the Geissler tube familiar to every high-school student, and which was invented about 100 years ago, is a cold-cathode tube. The neon signs which make or at least made a ruddy glow over most of our towns before they were quelled by dimout requirements are also cold-cathode tubes. These are quite efficient, but they are unsuited to general illumination requirements because of their color.

The thing which has made the cold-cathode tube

potential illuminant is a fluorescent coating on the inside of the tube which produces a high-efficiency lamp emitting light in usable colors. A number of successful installations have been made and these include a very limited application to car lighting. These had to be made without adequate engineering information on the characteristics of cold-cathode lamps. Such data are now available and are published in brief in the Electrical Section of this issue.

It seems unlikely that the cold-cathode lamp will find as wide application for lighting as its hot-cathode contemporary, but for specific application it has a definite place. Some standards of lamp length, voltage, sockets, etc., are being established and with engineering data available it can now be used intelligently.

Modern Shop Equipment Needed to Maintain Power

About two years ago when the defense program really got under way the railroads were in a position with respect to physical facilities wherein there was some question as to their ability to meet the pressure of greatly increased traffic. The fact that the roads have met the unusual demands of the last 24 months in a manner beyond the expectations of even the most optimistic was due as much to the ability of railroad personnel to use the facilities they had in a most efficient manner as to the facilities themselves.

In the matter of motive power the railroads entered this period with several thousand fewer units than they had in the peak traffic years of the pre-war period and as freight and passenger movements increased by leaps and bounds two factors, other than the human factor, made possible the performance records that have been established. These two factors are (1) the latent capacity of the modern locomotive to handle heavy tonnages at high speeds and long daily mileages and to keep this up for longer periods between shoppings, and (2) the ability of our railroad repair shops and engine terminals to overhaul or service equipment and get it back on the road in the least possible time.

In spite of the fact that on many roads relatively small groups of modern locomotives have been handling as much as 60 per cent of all of the freight traffic of a road the job that has been done could never have been done had it not been for the ability of the back shop to return to and maintain in service several thousand locomotives that were able to carry a share of the load in spite of the fact that they could not be operated economically.

Only those in the railroad industry who have had to live with the shop and engine terminal problem have any idea of the difficulties under which this job has been done. On most roads the largest part of the repair shop equipment is not only not modern but is definitely obsolete. In normal times the job of maintaining motive power and equipment does not impose too serious a burden on machine tools and shop facilities but in times such as we have experienced in the past two years the total shop hours, and consequently machine tool hours, has increased to such proportions that many of the tools with which shops are equipped have forcibly demonstrated their inability to meet present needs.

To side step the issue of the need for shop equipment any longer is to gamble with the ability to maintain the motive power and equipment which the roads need to do their part in the war effort. For purely patriotic reasons, if not for practical reasons, many mechanical men responsible for the condition of repair shops have assumed that while the nation was equipping its defense plants with new machinery the railroads should do everything they could to get along with what they had at a time when other industries had the first call on new machine tools. At present there are definite indications that the defense plants have reached a stage in their tooling programs where their demands on the machine-tool and shop-equipment industry are falling off and there is now a definite plan to divert a portion of the machine-tool productive facilities and manpower to the direct production of munitions.

There is plenty of capacity in the machine-tool industry to take care of the relatively limited needs of the railroad industry and now is the time when the railroads should make a thorough analysis of their machine-tool and shop-equipment requirements and take such action as may be necessary to guarantee the installation of such up-to-date units as will enable them to maintain the required high rate of motive-power and equipment-repair programs.

The effect of high-speed full-tonnage operation in both freight and passenger service is being reflected in the difficulties which are being experienced in locomotive and car wheel departments. One mechanical officer offers the opinion that the wheel shops constitute a serious bottleneck in the output of cars and locomotives. There are also many indications that new shop tools are badly needed in connection with the main and side rod, the turret lathe, and the piston and crosshead departments.

There are several reasons why new shop equipment is needed, of which the principal ones are to increase output, to decrease cost, to obtain greater accuracy and, possibly most important of all at this time, to compensate for the growing manpower shortage. Of these four, the last two are immediate reasons and the first two are what might be considered post-war reasons, for which it is well to be prepared.

If there are those who feel that the modernization of shop facilities can be postponed until after the war, it might be worth while to study this problem in the light of winning the war. The chances involved in postponement may be a deciding factor in a failure of our rail transportation system which every one in the railroad industry has worked so hard to prevent.

Roundtable

What About Hot Boxes?

A.A.R. Should Insist On Uniform Practices

During 43 years' service in the car departments of five trunk line railroads, I have had an opportunity to observe on many railroads the practices in wheel shops, the wheeling and journal box attention, and also the work of oilers in the transportation yards. I believe that the lack of *uniformity* is responsible for more hot boxes than anything else—that is, the kind of material used, handling of the material, and the workmanship in the wheel shops, and that of the carmen and oilers in keeping the journal boxes and contained parts in the proper condition. I have noticed that the railroads having the best records are those which follow a *uniform* practice in their attention to journal boxes. Each railroad, however, is depending on others, as well as private companies to do their part of the work and do it properly.

Railroads are less *uniform* about this feature of the work than anything else, and since hot boxes have always been the greatest single source of trouble, I believe the A. A. R., which has already gone a long way, should agree to *uniform* practices, leaving nothing optional. Also, as they have done on other work, have men with A. A. R. authority visit railroads and private car companies to see that the work is performed according to A. A. R. rules.

In attempting to place responsibility for hot boxes, nearly all will say it is a "man failure;" but have you ever tried to find the man? Is it the fellow who purchased the material, or the one who handled or used it; is it the wheel shop; could it be the switchman, the trackman, the road engineer, or the loader of the car? The more interest taken by all employees, the fewer hot boxes.

After all is said and done, there is more said than done—about hot boxes!—T. S. Cheadle, Chief Car Inspector, Richmond, Fredericksburg & Potomac.

Don't "Pencil Pack"

On the morning of the day on which your May number reached me I went through our waste reclaim department and saw our genial journal box packer getting a load of waste from the bin. As he pushed his wheelbarrow along the track I noticed that the waste was as springy as a load of well-cured hay and called his attention to the fine quality of the waste he was getting. He replied, "She is good waste." Later in the day I noticed the same man pulling waste from a car to be repacked, and Heine was having quite a struggle getting the waste from the box. The hook would pull through and he would only get a few pieces at a time. He remarked, "This one been too much pencil packed," and I wondered if he was not right. You know that "pencil packed" boxes are those on which the records have been changed but not the waste. I believe that the soggy mass of waste in these boxes, if left to make another trip, would soon cause the journals to heat.

I believe that some day we will, if we continue to use the present type of journal bearing, caliper every journal and apply to each a bearing that will fit it within $\frac{1}{32}$ in., thereby reducing the load per square inch to a normal figure and reducing the high temperature which results from "breaking in" a new bearing.

New men should not be used to pack journal boxes. An experienced hand knows by the feel of the waste when it is just right and will not pack it too tight; and above all, they must not be "pencil packed."

Just one more comment. In my opinion, all trucks should be equipped with some form of snubber springs to lessen the blows on bearings, caused by the bouncing of car bodies.—*Western Car Foreman.*

Snubber Springs Are Recommended

The question is asked, in regard to hot boxes, "Is it design; is it the bearing; is it packing methods; is it inspection, or is it supervision that is at fault?" All of these have, no doubt, been contributory factors in times past, and with the possible exception of the first two, probably caused an occasional hot box now and then, here or there. They will continue to do so, because human beings cannot operate at 100 per cent efficiency. However, a "perennial offender," to the writer, indicates a greater number of hot boxes than what should be considered normal. Your list does not include train speeds, which may be the cause of hot box epidemics.

Train speeds have been very materially increased during the past ten years, and since war was declared, more trains are operating at higher speeds than ever before. These higher speeds get into critical speeds where harmonic action (bouncing) occurs. For fully loaded freight cars the rate of bounce is about three per second at about 36 m.p.h. on 33-ft. rail, and about 42 m.p.h. on 39-ft. rail. For empty cars the rate of bounce is about six per second at about 70 m.p.h. on 33-ft. rail, and about 83 m.p.h. on 39-ft. rail. Of course, loads between these two extremes have rates of bounce between three per second and six per second.

What has all this to do with hot boxes? Just this. Fully loaded cars, and cars loaded down to about three-quarters of full load, when they bounce, will drive plain springs solid on the downward stroke. The instantaneous force of such blows, in the neighborhood of three blows per second, will very likely change the contour of the journal bearing, and may cause incipient cracks in other parts of the truck, which may eventually lead to failure. At the other extreme, empty cars, and cars loaded up to about three-quarters of full load, when they bounce, will throw the load off plain springs at about six to three and a half times per second, which means that from six to three and a half times per second there is no pressure on the journal bearing, and the bearing may be going up and down at the same rate. Under such circumstances it is relatively easy for a strand of waste to get between the bearing and the axle journal. That may not mean a hot box on that particular run if the car is empty, or even if the car is carrying a light load, but unless discovered and corrected before the car is more heavily loaded, a hot box, in all probability, will result.

What is the remedy? The writer quotes from the report of the Committee on Freight and Passenger Car Maintenance of the Car Department Officers' Association for the 1940 annual meeting, under the heading, Hot Boxes, as follows: "The use of snubber springs on equipment of all kinds is recommended, as it is felt that snubber springs will, by decreasing the frequency of solid blows, help eliminate some of the causes for hot boxes."—*Cyrus J. Holland, President, Holland Company, Chicago.*

Oil Largely Responsible For Mechanical Difficulties

The railroads of the northern half of the United States experience peaks in the number of hot boxes during July and August, and occasionally in September. Another peak of about the same magnitude occurs in January and February, extending sometimes into March. Since this is a more or less general condition, there must be a common cause. In our opinion it is largely to be found in one of the inherent properties of all petroleum lubricating oils, that is, the change in viscosity with temperature. In cold weather the oil becomes viscous and flows poorly. A lubricating device that depends upon capillary action to feed the oil to the bearing is likely to suffer. On the other hand, in hot weather the oil thins out and tends to go to the bottom of the box. It will be drawn up to the journal by capillary action in suf-

cient volume once the flow has become established.

In view of the relatively small number of hot boxes compared to the number of journals in operation it is clear that the simple arrangement that is employed for lubrication is remarkably successful. It is also clear that minor defects in the system are not the major cause of hot boxes, although they are the cause of a part of them. The lubricating oil is the major element entering into lubrication and anything that affects it adversely can be expected to cause hot boxes regardless of who owns the car or who put the oil into the box. The presence of dirt, water, fatty acids, tarry matter, soap, and various other contaminations have an influence on the lubricating properties of the oil, but in most cases the oil goes on functioning in spite of these unless the amounts are excessive.

If the oil is responsible for the major portion of hot boxes, what is the remedy? It certainly is not to be found in ordinary changes in the specifications for either new or reclaimed oil. It is the opinion of the writer that the A. A. R. Specifications for these items provide suitable grades of oil. The remedy for a large number of hot boxes is to be found in fortifying the lubricating oil where it is deficient. In cold weather it is best fortified by the addition of a light oil poured on the packing on the rising side of the journal. Possibly additions of the regular car oil would be satisfactory if warm oil could be used. This appears to be quite impractical. However, a light oil with a viscosity of about 100 seconds S.U. at 100 deg. F. and a pour point of around —50 deg. F. has served effectively on the Milwaukee. As pointed out in an article in the Railway Age of May 28, 1938, the use of this oil has helped to reduce hot boxes in the winter months very extensively. Application of the oil in the train yards just before leaving the terminal is a regular practice when the temperatures drop below +15 deg. F.

The remedy for hot boxes in summer months does not lie in the addition of heavy oil. Ordinary car oil has sufficient viscosity to lubricate the journal satisfactorily, as is proved by the majority of the journals giving no trouble. Consideration of the fact that the journals also operate very well with much lighter oil, for example, when the so called "free oil" mentioned above is used in winter months, shows that it is not higher viscosity that is required. What is needed is to get the oil from the bottom of the box to the journal. No oil, no matter how good it is or what the viscosity is, will lubricate a journal it does not reach. Records indicate that the first few miles, possibly up to 25 from the terminal, are the most critical. This seems to indicate that the oil has begun to circulate properly by this time if it is going to at all. What is needed, therefore, is enough oil applied to the packing on the rising side of the journal to reestablish circulation; in other words to take care of the lubrication until the circulation is established.

It is realized that the above recommendations will not eliminate all hot boxes. Hot journals due to mechanical defects may scarcely be affected. Only good inspection, making the indicated repairs and in general keeping the trucks in good mechanical condition will affect this type of hot box. Passing the buck to the next foreman on the line is not going to help at all.

There are some mechanical changes which the author feels could be made to improve the hot box record. One of these is to reduce the clearance now allowed between the bearing and the bosses in the box which maintain the brass in position. This is now 3/8 in. and allows too severe an impact load between the bearing and the ribs. The badly battered condition of the sides of brasses appears to be good evidence that this tolerance is too large. As the brass becomes deformed the babbitt is squeezed out into the oil groove at the edge of the lining. This interferes with the proper circulation of the oil. Also the battering of the bearing produces a rough and ragged condition on the edge of the brass which provides a place to catch any stray threads of packing and lead to a wiper. Excessive wear of the ribs in the box contributes to the amount of movement possible for the bearing. These ribs could be restored to the original or other desired dimension very readily by welding. This is a matter that could and should be studied by the A.A.R. since it is common to all railroads.

The type of packing that is used has some influence on the lubrication but it seems more important to maintain it in good condition. Excessive amounts of fine dust, whether abrasive or otherwise, will interfere with oil circulation if nothing more. Well fitting lids, dust guards that are properly maintained and renewal of the packing at the required intervals, will all help to reduce hot boxes that may be due in whole or in part to these causes. *L. E. Grant, Engineer of Tests, Chicago, Milwaukee, St. Paul & Pacific.*

Supervision a Large Factor

What has been done to improve the design of bearings? The answer is practically nothing during the past 70 years, since the present design was adopted as standard.

What is being done to improve design and performance? The answer also is practically nothing.

What can be done to improve design and performance? The present design was well conceived and from a practicable viewpoint has stood the test of years of severe service. Recent minor changes in design of the standard bearing (not temporary war standard) will tend to reduce the number of hot boxes and correspondingly increase the service life of bearings.

If earnings permitted, and if it were practicable to give each freight car the same relative attention as each of the more modern locomotives and passenger train cars receive, roller bearings would seem to be the solution of the hot box problem on freight cars; however, as neither of these barriers can be hurdled in the foreseeable future, we are confronted with the problem of what can be done under present and normal conditions to improve the performance, and to that end I submit the following:

1. Reduce coupling speeds of all cars to not more than five miles an hour. This is necessary to prevent waste grabs.
2. Many hot boxes are caused by severe

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Please Tell Us!

One of the most amazing technological developments in recent years, and particularly during the present World War period, has been that in the field of plastics. The railroads, hard pushed for essential materials for freight and passenger cars, have sought eagerly for substitutes. A mechanical department executive has asked us this question: "Can plastics be used effectively and advantageously for the replacement of metals in car construction?" We need your assistance in answering this question in our July Roundtable. Tell us just where and how they can be used to advantage. Your letter must be in our New York office not later than June 14. Have you a question that you would like to see discussed in succeeding Roundtables?

lateral thrusts, vertical bouncing and rolling on poor track and on curves, because of excessive speed of trains in relation to physical condition and design of the conventional journal box assembly and method of lubrication. These factors should be considered by operating and mechanical officers when determining maximum speed of trains. The usual practice is for operating officers to determine the speed of freight trains on basis of the maximum speed the equipment, bridges and track will stand and not cause derailments; and so long as this practice governs, hot boxes will continue to be a real source of trouble.

3. Use the correct amount of properly prepared and/or renovated packing in accordance with A.A.R. specifications. Examination of packing in boxes recently repacked indicates A.A.R. specifications in many cases are not being fully complied with. Maintain trucks in better condition than is now the practice, giving particular attention to condition of wheels, journal bearings and wedges. See to it that cars, both open and closed types, are loaded in accordance with A.A.R. loading rules. Improperly loaded cars, especially in cases of overloads and loads unevenly distributed, which result in excessive weight on one end or one side of cars, is the direct cause of many hot boxes.

More intensive and intelligent supervision will greatly reduce, if not eliminate hot boxes, many of which result from failure to comply with approved practices herein enumerated.

In conclusion, much may be accomplished through the exercise of unceasing effort on the part of all car department officers in seeing that the supervisors are impressed with the necessity of the use of proper practices in the maintenance of equipment, and that operating departments are kept aware of the deleterious effects of excessive switching and train speeds.—*F. G. Moody, Superintendent Car Department, Northern Pacific.*

Emphasizes Strict Attention to Details

Yes, one hot box is one too many. In every train of 100 cars, we have, with the present box assembly, 800 potential hot boxes, thus emphasizing the importance of proper attention at each point of inspection.

There are many mechanical as well as lubricating factors that contribute either individually or in combination to the failure. If the journal bearing, the wedge, the top of the box or the journal itself are not in satisfactory condition, or if the packing is not properly applied, it is apt to cause trouble. More consideration should be given to the potential hot box. Many failures could be prevented if remedial measures were taken before journals run hot. Poor journal protection invites trouble and as long as we allow water and other foreign matter to enter the box freely and mix with the oil and waste, hot boxes will be with us.

The A. A. R. rules define the quality of oil and waste—new and reclaimed—to be used, and these requirements should be strictly observed to insure that the oil delivered between the bearing and journal is of sufficient film strength to carry the load. *Of first consideration is strict attention to details.* If better results are to be secured, there must be unity of purpose and the success of our effort depends upon how well we school and instruct our men, for no matter how good the quality of the waste and oil may be, a satisfactory performance cannot be had with mechanical defects present.

In addition to careful examination of the mechanical details, including wheel shop practices, care must be taken to see that the waste is of satisfactory quality, properly saturated with a good grade of oil and the packing properly applied in the box to insure capillary attraction and a continuous flow of oil to the point of lubrication. *Let me emphasize that most of our troubles could be overcome by competent workmanship, rigid inspection of details and constant vigilance. In short, we must make our organization hot box conscious and impress upon all concerned that such failures are expensive, and cause delays and inconvenience.* Closer attention and policing of the work will pay big dividends.—*D. W. Ditmore, Master Car Builder, Delaware & Hudson.*

Must Practice Greater Refinement

Successful journal box lubrication is dependent on a great many mechanical conditions, and the greater the degree of intelligent refinement applied, the greater degree of success will be enjoyed. I use the word "enjoyed" advisedly.

Then there is the multitude of other affecting conditions, such as climate, terrain, train speeds and handling, conditions that vary widely in different sections of the continent.

Each section is wise to its worst season. For example, in the Northwest we look forward each autumn to our red flannels and to hot boxes, as their seasons are coincidental. The more careful mechanical attention devoted during the hot box slack season, the better prepared you are going to be when conditions get bad. Since there are 100 direct or contributing causes for hot boxes, year around thoroughness is absolutely necessary.

True, when the trouble reaches epidemic proportions a large measure of it may be attributed to certain causes, simply because those are the weakest links. Study those carefully and do something about them before next epidemic season. Study your oil characteristics, particularly its reaction to cold, heat and moisture. Oil that congeals to a sticky mass is not a good cold weather oil, neither is one that becomes very thin in hot weather.

Clean oil of proper characteristics and good, well-cleaned waste are good starting points. Bearings must be thoroughly inspected and the defective ones removed. Wedges must receive the right attention—particularly watch that hump. If you use flat wedges you are asking for trouble and you, or someone else, is going to have it.

The fit of the applied bearing to that particular journal is no doubt one of the strides that can be made in successful lubrication. On the Great Northern we have developed a practical method for doing that and also for making a considerable saving by using reclaimed bearings on system cars. This method has been in successful use for seven years on both freight and passenger cars.

One of the "niggers in the wood pile" is the dust guard, a misnomer if there ever was one, since after a very short time it certainly does little guarding. We have found that much trouble was due to wipes and small grabs. These can generally be removed before they get under the bearing, by the use of a special small, fine edged hook. Use good lids on the boxes. Watch your journals to prevent scratching of any kind. Watch your wheel mounting. Many hot boxes are directly due to improper wheel shop work.

Out-of-round and comby wheels cause hot box trouble, as do stiff center plates, car down on side bearings, and bad spring action due to absence of effective friction truck springs or snubbers. Weak and slack draft gears cause undesirable car shocks that are transmitted to the journal bearing, often "jumping" the brass and causing a grab. There is one cause that is much maligned, and that is insufficient oil in the box. The quantity of oil actually working is only a few drops; getting those few drops up when and where needed is the problem, but that will not help either, if other major constituents of the box assembly are defective or not functioning properly.—*P. P. Barthelemy, Master Car Builder, Great Northern.*

The Emergency Journal Bearing

The design and strength of the present emergency bearing is not right for present-day operating conditions. This bearing has been thinned, both in lining and shell thickness. Except in rare cases, it will not stand ordinary heating above that which melts out the lining, without breaking up the shell which may lead to further trouble.

The reduction of ¼ in. in the side pads has also weakened the brass. This section should be put back to the 1940 brass structure for strength and, in fact, should be made stronger.

The depression on the center of the back has weakened the brass. Its purpose, I presume, was to reduce the weight at that point to prevent lining run. The thinning of the side pads also was done to prevent contact with the box stops and lining run. If these changes did away with the spread linings, the use of the trimming machines should be on the decrease rather than on the increase.

Spread linings are caused by heat. The heat is caused by lack of sufficient lubrication. The lack of lubrication, in this case, is caused by wiping the journal. The wiping of the journal is caused by

waste rolling and packing under the box stops, and at the side ribs projecting from the box sides of some boxes, when the journal lags to the rising side. This wiping has several stages:

1. To the extent of creating a high polish on the lining (inspect the 6-in. by 11-in. brasses you remove at wheel changes for this pronounced condition).

2. To the extent of causing babbitt flow due to insufficient oil reaching the bearing surface at a localized point.

3. To the extent of an oil breach along the side, of sufficient length to prevent drawing from the end locations of the waste in the box. This heat will melt out the lining if not detected in time.

When the babbitt spreads, as in item (2), it will run in many cases ¼ in. to ⅜ in. or more (this is where the trimming machine comes in). If this spread lining condition is not taken care of, it is liable to collect waste and cause a secondary wiper and perhaps a waste grab.

The change in the 20-80 per cent solder will not do a perfect job unless great care is used in its manufacture. Therefore, railroad inspection must be minutely and thoroughly carried out.

More frequent repacking and periodic inspection of journal bearings is necessary.

Back rolls called for in the 1943 Rule 6 are either improperly made or some people are trying to oil the roadbed. I believe a properly made hand-spun roll is the best, as in zero weather the man making rolls by hand can do a much better job with the spun roll made in the oil house.

Improved journal bearings and journal boxes are in order for better operating conditions; either or both are available.—*P. J. Hogan, Supervisor Car Inspection and Maintenance, N. Y. N. H. & H.*

Change the Design to Insure Good Lubrication

I have been in charge of a wheel shop for the past 20 years and have had many headaches because of hot boxes. I have inspected many cut journals coming to the shop and believe that at least 75 per cent of the hot boxes are caused by lack of lubrication in the load zone of the journal; this is caused by the design of the box and the method of supplying the oil to the journal brass. I have noticed many hot journals coming to the shop, the wheels indicating that they have run from 1,000 to 5,000 miles or more before the hot box. The journals show lack of lubrication in the load zone; this failure can be traced back to a wiper caused by dirt and lint getting on the edge of the brass and wiping the oil from the journal as it is carried up to the brass from the packing. It is a known fact that the brass does not fit the journal on the full arc of the brass when it is first applied, and does not form a true fit because of the movement of the box and brass while the car is in motion. This allows dirt and pieces of waste to lodge on the edge of the brass and between the brass and the journal.

I would suggest a design of box in which oil flows directly to the journal through the brass, either by paddle or pump arrangement, and place a seal on the dust guard and on the box lid to retain the oil in the box.

I have inspected and worked roller bearing journals and have found bearings on which the sleeves and rollers and housing were badly pitted and shelled out, and still they did not fail while in service. All of these boxes showed that lubrication was getting to the bearing at the load zone at all times. Many times I have found the oil very dirty and parts of metal in the box, and yet the box showed no signs of heating.

I know that there has been a great improvement in the class of workmanship in wheel shops in the past 20 years. However, we still have hot boxes, and the same type of journal boxes is used on freight cars as years ago, while train speeds and carloads have greatly increased. There are a large number of hot boxes that cause wrecks and bad delays. This great loss of money and material could be reduced by proper lubrication of journal boxes. I do not mean by the use of roller bearings, but by the use of an oil well in the box and a mechanical means to place the oil to the top of the brass, so as to let it flow through the brass to the journal and do away with the waste packing.—*A Wheel Shop Foreman.*

Do a Real Job With Properly Trained Men

At least 97 per cent of all heated journals could be eliminated by proper maintenance of equipment by men adequately educated on journal conditions and contributing causes to journal heating.

We have always had success in getting all cars over the railroad without failure and without heated journals when special trains are set up and close inspection given, and the work properly supervised by supervisors that knew their jobs.

In most all cases where time is lost because of a heated journal, it is the result of improper maintenance due to lack of the right kind of supervision, and the men performing the work not being educated and schooled in proper workmanship. This schooling should include truck equalization and the detection of worn oil boxes, which result in unevenly distributed weight on the journals, and boxes worn to the extent that journal bearings are riding at an angle on the journals, rather than being properly seated the full length, as they should be.

Apparently the roads that have the most heated journals are lacking, insofar as efficiency is concerned, on inspection of journal boxes and truck conditions that contribute to heating journals. Ofttimes the supervisors that instruct the men are not really qualified to say just what conditions contribute to heating journals.

Where we have efficiency on the part of the workmen who know their work and have sufficient time to do it properly, cars make millions of miles per hot box. This is evidence in itself that more attention and better education on the part of the individuals having anything to do with journals and journal bearing attention could eliminate at least 97 per cent of all our failures due to hot boxes or hot journals. The other 3 per cent could be eliminated by the use of an oil bag or sack, with a fine grade of lubricating oil inside, and sealed with a thermal element attached to rupture the oil bag on each side of the journal. When the journal reaches a high degree of heat but not before the danger point is reached, the oil would thus cool the journal and prevent a dangerous heating condition and allow the car to reach its destination. —*J. F. Swafford, Car Foreman, Washington Terminal Company.*

Waste Grabs

Records show that the primary cause of over 50 per cent of all hot boxes is attributed to waste grabs, a condition created from a disturbance of the journal packing and aggravated by excessive switching shocks, train slack run in, etc. This being recognized, it would appear that by eliminating the known causes of waste grabs, a decided reduction in the number of hot boxes could be assured.

The question is, what must be done to eliminate these causes? One able authority has stated, *"Careful inspection and preparation of journals, bearings and wedges; proper maintenance of bearings and boxes in train yards and on repair tracks, and a continuous campaign of education are all necessary to bring hot boxes to a minimum."* He is quite right and much success is ahead for the road on which it is the practice to so handle. Practice in this case means adopted practice strictly adhered to, not intended practice applied only when convenient. The purpose of education and the interest instilled in the minds of the employees is apt to abate if the practice does not permit servicing of all boxes. To reduce, if not eliminate, waste grab it is essential that the interior of all boxes be inspected and properly serviced after the cars have been subjected to switching shocks and assembled in trains ready for departure. It may be said that this is not always possible, that time between train connections, late make-up of trains and many other operating conditions prevent proper servicing. To this comment I would say that slight delays, if necessary, in train yards are not so costly and troublesome as delays en route; therefore, it is to the advantage of every railroad to do everything possible prior to train departures.

Along with proper servicing, an educational program through the use of posters displayed in train yard lobbies will be found very helpful. The posters should picture the interior of a journal box and show just what happens in impact at various switching speeds, the idea being to acquaint switching crews with developments in impact and thereby arrive at a safe controlled switching speed.—*J. P. Jangro, Superintendent Car Maintenance, Boston & Maine.*

Shop Manifolds On a Post Between Pits

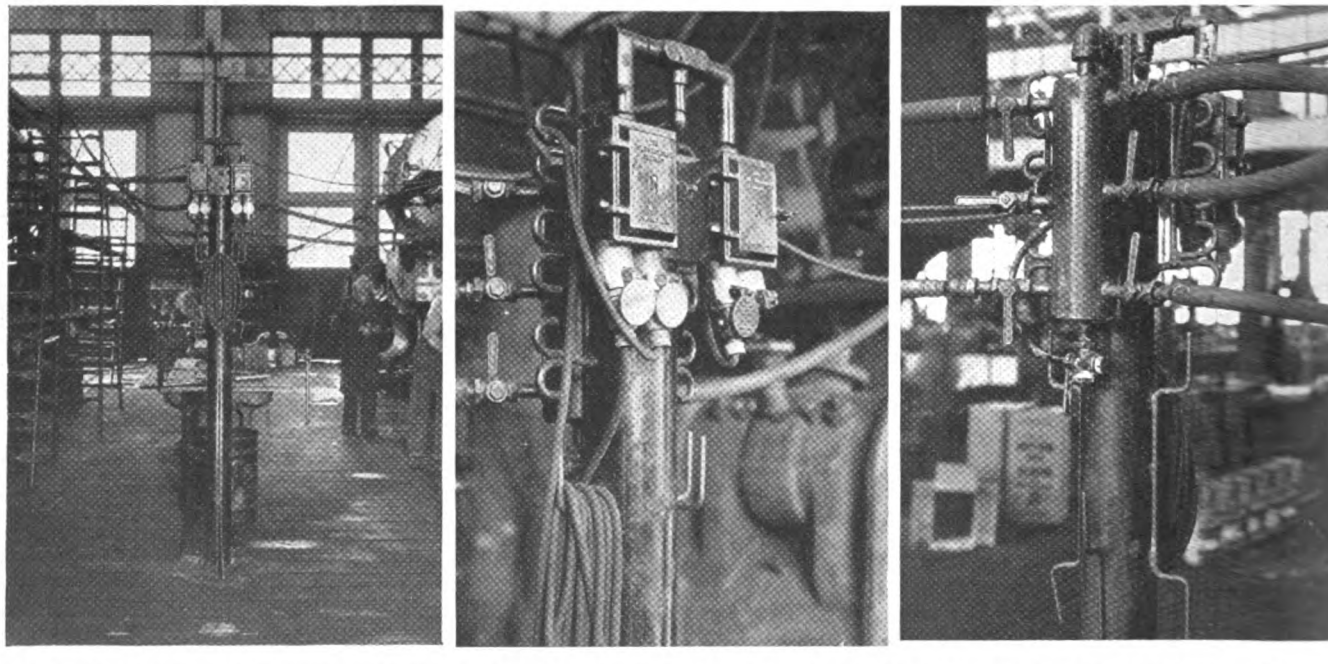
A shop manifold post for the orderly distribution of pneumatic and electric power from central points between transverse pits in the erecting shops has recently been developed at the Springfield, Mo., locomotive shops of the St. Louis-San Francisco. The post includes an air manifold for supplying air required for portable shop tools, and Pyle-National junction boxes and switches for connection to electric welding machines and electric-light extension cords. Air-hose connections were formerly made from the pit and electric-light extensions were taken from the side wall of the shop. The use of the new manifold posts not only avoids damage to air hose and light cords, which are carried overhead directly to the locomotive on each side, but the length of the hose and light cords has been reduced from 50 ft. or more to 30 ft., thus conserving rubber and copper, which are critical materials. In addition there is an important safety factor in the removal of these hose and light-cord extensions from the floor where they interfere with the work and constitute a safety hazard.

Referring to the illustrations, the general construction of this improved manifold post will be apparent. It consists of a scrap 5⅜ in. superheater flue, 7 ft. long, mounted on a base plate 20 in. in diameter which is bolted to the shop floor and has three ¼-in. gussets welded in place to stiffen the construction. A 1¼-in.-pipe air line and a conduit with the necessary electric wires pass from the shop floor up through the manifold post to the top where the air is piped to a six-outlet manifold made of 3½ in. extra-heavy pipe with ½-in. steel ends welded in place and the manifold itself supported by the intake pipe at the top and suitably bracketed to the vertical post. Three air-hose connections are available on each side of this manifold and a valve at the bottom permits draining out the condensate when necessary. This manifold may be varied in length to suit individual requirements.

Electric connections are made from the top of the manifold post by means of a tee and flexible conduit to two Pyle-National two-pole, two-gang receptacles mounted on a ¼-in. steel plate which is bolted to the post. Four electric outlets are thus made available at each post. As in the case of the air pipe connections, the electric light and power extension cords are carried directly from the junction boxes to the locomotive on either side and thus kept off the floor. Short double hooks, around which the electric cords can be easily applied near the junction boxes, take all strain off the electric connections and avoid kinking the cords by too sharp a bend. A short section of rubber hose is slipped over each cord and equipped with a wire hook for attachment to the locomotive, thus protecting the electric-light extension at this point.

One of the interesting features of this manifold post is the use of special hooks made of ¼-in. steel bent to the shapes shown and welded to the post. These hooks provide the necessary means for keeping air hose and the electric-light extension cords neatly coiled in place when not in use. The cords remain at the post and this avoids the necessity of carrying them back and forth to the tool room at the end of each day's work.

Where 50-ft. cords were formerly required with electric connections from the side walls, 30-ft. cords are now found adequate. The length of service of electric-light extension cords was formerly limited to three or four

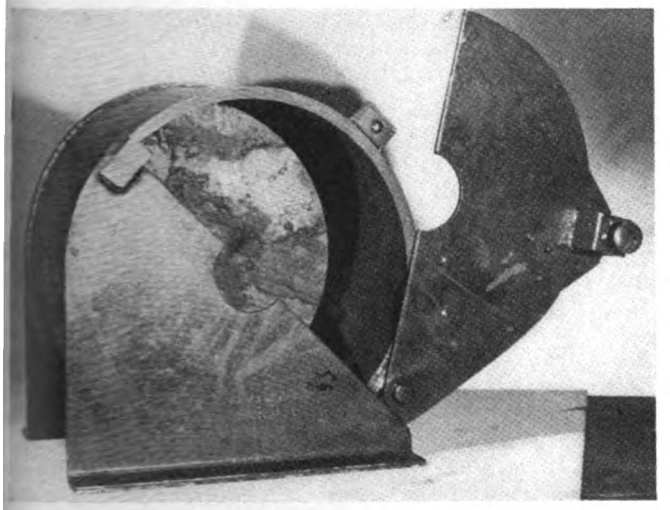


Left: Manifold post which is used at the St. Louis-San Francisco locomotive shops at Springfield, Mo.—Center: The electric connections—Right: The air-hose connections

months, primarily due to cutting, but present indications are that substantially increased or almost indefinite service life can be secured by using the equipment and precautions described. The increase in rubber-hose life has similarly been increased from about 1½ to 3 years.

Speed Testing of Grinding Wheels

By equipping tool cribs with this simply constructed speed-test chamber, General Electric manufacturing departments have minimized the possibility of accidents from damaged or overspeeded grinding wheels on portable grinders. Workmen are encouraged to bring their grinders to the tool crib for a test if there is any question as to the condition of their grinder or the grinding wheel. When a workman needs a wheel for a portable



Grinding wheels are tested in this speed-test chamber at 50 per cent above normal speed before being placed in service

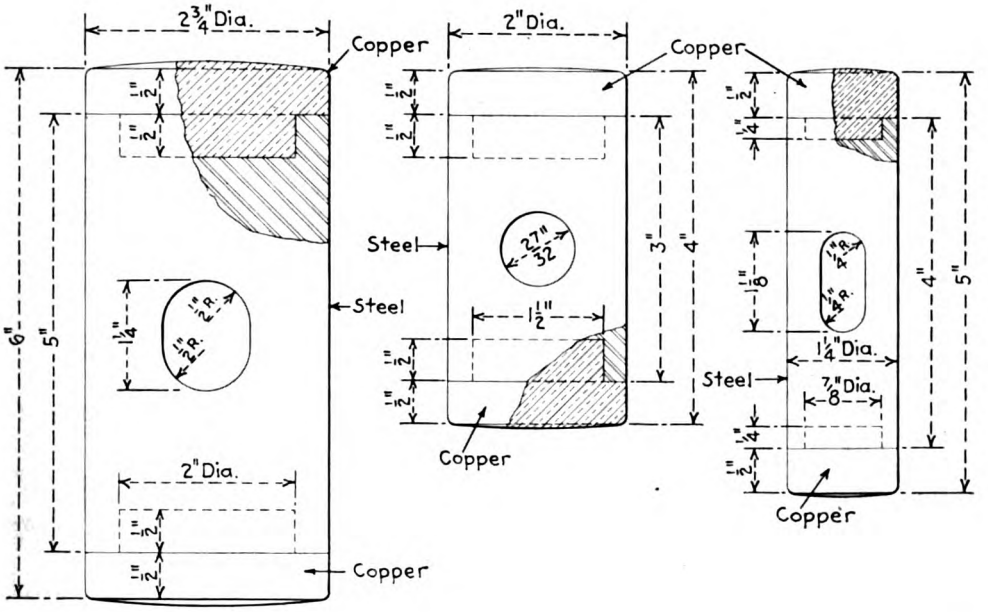
grinder, he takes his grinder to the tool crib. The attendant mounts the wheel on the spindle of the grinder and puts the grinding-wheel end of the spindle into the speed-test chamber before starting it. With the test chamber closed around the spindle, there is no danger to the operator if the wheel should burst while being tested. As an initial precaution, all new grinding wheels are tested at 50 per cent above normal speed before they are placed in stock.

Arc Welding for Aluminum Piston Lands

A satisfactory method of using electric welding for building up piston-ring lands of aluminum pistons used on Diesel-electric locomotives has been developed in the shops of Northampton and Bath, Northampton, Pa. The welding is done with a Lincoln Aluminweld rod, ⅛ or 5/32 in. in diameter, and the machine setting is about 300 amp. at 15 to 20 volts reverse polarity. It is necessary to preheat with a torch to about 100 deg. F. The piston to be restored is laid on its side and is rotated while the work is in progress, so that the point where the welding is done is always a vertical surface. By this procedure, most of the slag is disposed of by gravity. After the lands have been built up, they are machined to their original size.

Soft Hammers With Copper Tips

The copper hammers used for striking upon finished bolts or surfaces of car and locomotive parts are of widely varying shapes and weights but contain considerable metal. To conserve copper for the war effort, the Southern Pacific general shop at Los Angeles, Calif., makes its copper hammers primarily of forged steel. There is a shallow counterbore in each end, this counterbore being filled with a copper insert which extends beyond the steel to form a copper tip over the entire face of the hammer. Three sizes of hammer are shown in the illustration, two pounds of scrap copper in the larg-



Steel hammers with scrap-copper tips, deposited with an oxyacetylene torch, are used at the Southern Pacific shops, Los Angeles, Calif.

est hammer doing the work of nine pounds. The copper is deposited by the oxy-acetylene method.

Repairs are made by building up the worn faces with scrap copper applied with an oxy-acetylene torch. The steel part of the hammer never wears out. To maintain and repair one copper-tipped hammer over a period of several years promises to be less than the cost of maintaining the old style hammer made of solid copper.

Reclamation By Metal Spraying

The use of sprayed metal in reclaiming and rebuilding worn locomotive and car parts has resulted in cost savings and longer service life for such parts. At present, probably its greatest value lies in the fact that material shortages can be partly overcome by the reclamation and retention in service of otherwise difficult-to-obtain repair or renewal materials.

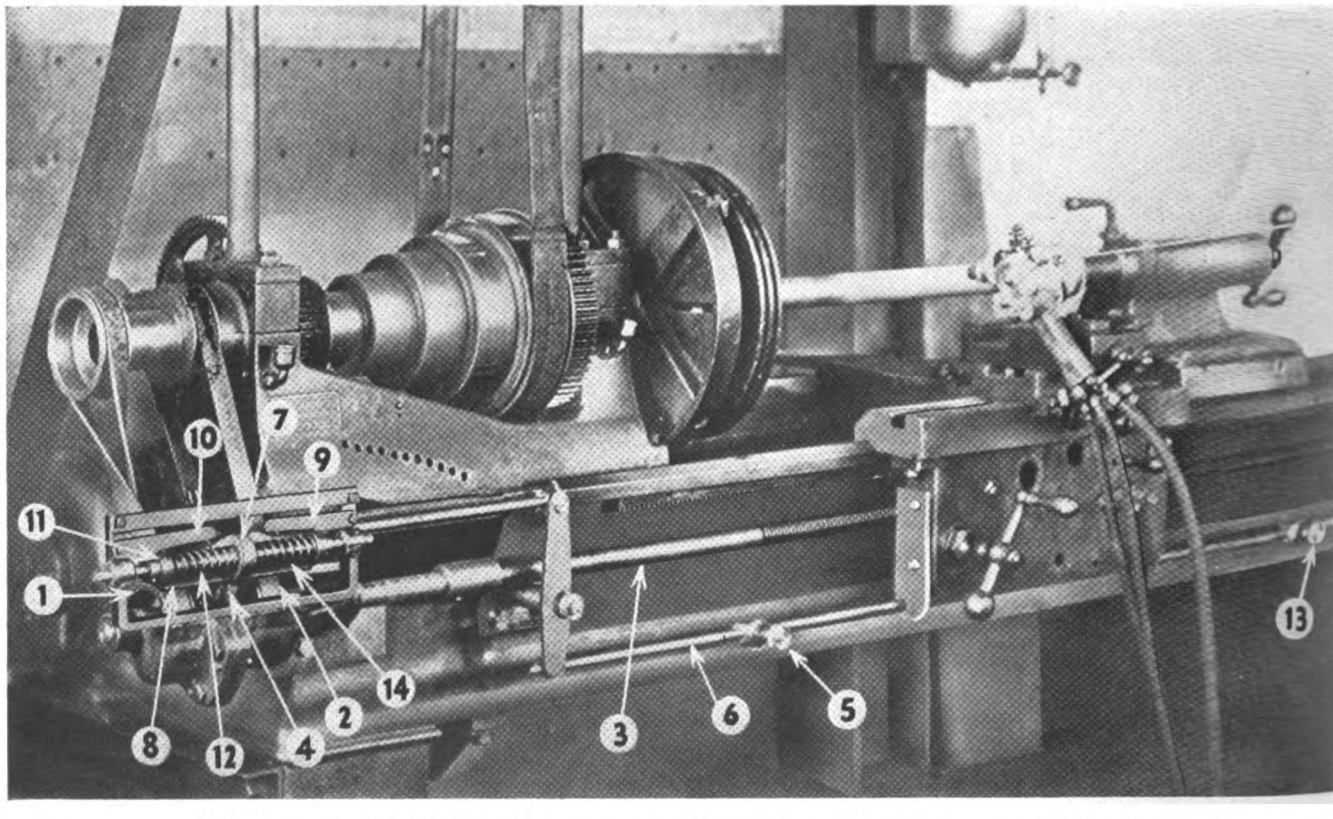
One of the earliest roads to enter extensively into the reclamation of parts by rebuilding with the metal-spray process was the Reading. A complete shop installation at Reading, Pa., enables this road to restore many different parts to service at minimum cost and in the shortest possible time. The shop has all necessary equipment for the preparation, spraying, and cleaning of a wide variety of locomotive, car, multiple-unit electric, Diesel and marine equipment parts. A partial list of items handled is shown in the table.

Comparative Costs and Savings Effected by Metal-Spray Reclamation

Items reclaimed	Reclamation cost, per cent
Power reverse rods	38.1
Pump piston rods	29.7
Electric turbine shafts	10.8
Universal joints	17.1
Hose couplings	58.3
Shafts	76.6
Emery wheel shaft	84.0
Lubricating shafts	74.5
Governor shaft	73.9
Friction shaft	70.2
Valve stems	15.9
Stoker pins	75.4
Valve motion rods, boiler house	38.5
Valve rod, a.c. gen. eng. No. 1	35.2
Fire door cylinder	16.3
Independent brake valve key	55.4
Bell ringer piston	88.9
Barco ball joint	27.7
Bushing, gas electric	70.6

An automatic reversing mechanism has been applied to the lathe used to hold metal spray unit while it is being used on long travel work on cylindrical parts. The use of this device permits the building up of sprayed metal to the ends of the work piece without the deposit of any excess metal which would later have to be machined away. The device is shown in the photograph. Two idler pulleys *1* and *2* operate on the leadscrew *3* and are engaged to drive the leadscrew when the clutch *4* is moved either to the right or to the left. When the idler pulley *2* is engaged, the leadscrew turns clockwise and brings the tool carriage to the left. When the carriage approaches the end of its travel, set by stop *5*, shaft *6* moves toward the left. Plate *7* is a trigger release which is keyed to the extension of shaft *6*, and is slidable on bracket *8*. The clutch *4* is bolted to the bracket *8*. Triggers *9* and *10* are stationary and are pivoted to the housing of the reversing mechanism.

When the lathe carriage moves to the left from its starting position, trigger *10* is engaged at the shoulder of the clutch bracket at *11*. Soon after the carriage strikes stop *5*, the trigger *10* starts to mount the beveled edge of the trigger release plate *7* during which time the spring



Reversing mechanism which assures application of an even coating of sprayed metal on cylindrical parts

12 is compressed. When the trigger *10* has raised far enough to disengage itself at *11* from the clutch bracket *8*, the spring *12* is released and forces the clutch bracket *8* and the clutch to the left. This disengages the clutch from idler *2* and it engages idler *1*. Idler *1* is driven from the machine spindle by a crossed belt and the lead-screw immediately starts rotating in a counter-clockwise direction and feeds the carriage to the right.

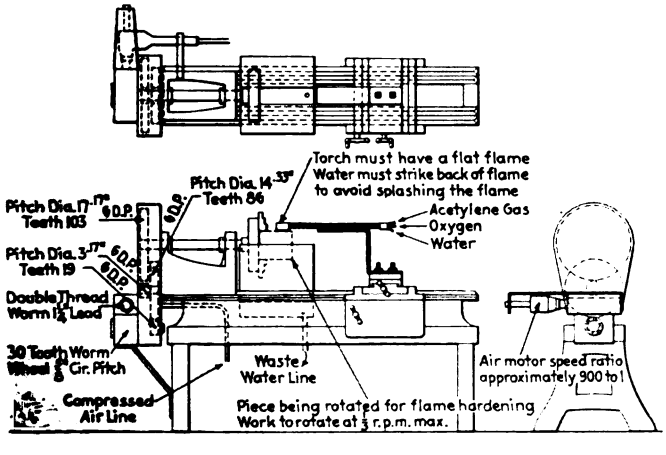
As the tool carriage approaches stop *13* the procedure is reversed and shaft *6* and its extension moves to the right, pulling trigger release plate *7* and compressing spring *14*. When the trigger *9* has been raised high enough to release the clutch bracket, spring *14* is released to force the bracket and its clutch to the right and pulley *2* is engaged. This again reverses the direction of movement of the carriage.

The use of this reversing device has proved valuable in reducing the consumption of spray metals, in reducing the time required to spray materials being rebuilt, and in reducing machining time required in the finishing of sprayed parts.

Flame Hardening On the Southern Pacific

Flame-hardened steel knuckle-pin bushings in locomotive connecting rods are replacing brass bushings at the Southern Pacific general shops, Los Angeles, Calif. This is prompted by the fact that there is practically no movement between pin and bushing. For each locomotive equipped the brass released average 85 lb.

The steel bushing and the pin must both be flame hardened. For this purpose an old lathe was arranged as shown on the sketch. The work rotates at a speed not



A lathe, no longer useful for other work, was converted for use in flame hardening knuckle pins and bushings

greater than one-third of a revolution per minute. The oxyacetylene torch is held rigidly in a bracket and a flat flame is used. Immediately after the flame application, the hot work is chilled by a water jet. This jet is set to avoid splashing the flame.

While the labor cost of flame hardening adds to the over-all cost, the length of service expected from the flame-hardened parts is four times as long as formerly. Measurements of hardened steel bushings and pins show that the wear at the end of one year was .001 in.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Drilling Rivet Holes Before Forming Plates

Q.—When drilling rivet holes in shell courses, longitudinal seam welt strips, etc., before rolling plates, it is customary to drill these holes undersize, reaming them out after the various plates have been assembled ready for riveting. What is the correct allowance to make in the rivet hole size for fitting up the plates?—D. P. H.

A.—To have rivet holes true when the plates are assembled, the actual diameter needed to receive the rivet is obtained by reaming or redrilling the holes after the parts are assembled. Locomotive boiler builders have found that, in order to assure true holes when reamed or redrilled, the drilled diameters of rivet holes in the flat plates should be as follows:

Drilled holes in longitudinal seams and welt strips should be equal to the diameter of the rivet before driving, minus $\frac{5}{16}$ in.

Drilled holes in all circumferential seams under steam pressure (except firebox roof sheet to shell course and firebox throat sheet to shell course) should equal the diameter of the rivet minus $\frac{1}{8}$ in.

Drilled holes for seams between the firebox roof sheet to shell course, firebox roof sheet to backhead, firebox throat sheet to shell course, and front tube sheet should equal the diameter of the rivet minus $\frac{3}{16}$ in.

Rivet holes in shell courses for angles and liners should equal the diameter of the rivet minus $\frac{1}{8}$ in.

Rivet holes in shell courses and firebox roof and sides for brace feet, supports, and roof sheet liner holes should equal the diameter of the rivet before driving.

Holes in firebox crown and side sheets, when riveted, should equal the diameter of the rivet minus $\frac{1}{16}$ in.

Firebox backhead, throat sheet and firebox ring rivet holes should equal the diameter of the rivet minus $\frac{1}{8}$ in.

Oxy-Acetylene Cutting of Firebox Side Sheet Patches

Q.—Is it satisfactory to cut out a firebox side sheet patch, $\frac{3}{8}$ in. thick, with an oxyacetylene torch? What methods are used to prevent the buckling and warping of the sheet while cutting same?—F. M. K.

A.—It is common practice on locomotive boilers to repair the firebox side sheets by cutting out the affected area with an oxyacetylene torch and also to use the oxyacetylene torch to cut out the patch to be applied. Little difficulty should be experienced with warping or buckling due to heating while cutting a $\frac{3}{8}$-in. plate with an oxyacetylene torch, especially in an area the size of the average firebox side sheet patch. The best method of overcoming warping and buckling while cutting is to clamp the plate securely to a solid member or base plate in a manner which will resist the expansion and contraction movement of the sheet while it is being cut. Another method of overcoming warping and buckling is to skip-cut the metal in the same manner as skip welding is

done. A series of cuts are made leaving a bridge of from 1 to 1½ in. between each cut. The bridges hold the sheet in alignment until it has been cooled sufficiently to allow cutting the bridges without further danger of warping. Oxyacetylene cutting of firebox side sheet patches is very useful because of the irregular shape of most of these patches.

Determining Limit of Pitting on Boiler Shells

Q.—We have a pitted boiler shell on the first course of a Mikado type engine, the pitting being at the bottom of the shell. The shell plate was originally 13/16 in. To what depth can the pitting extend before it will be necessary to patch the shell course?—D. L. S.

A.—Pitted areas in boiler shells should be patched when the factor of safety, based on the strength of the shell in the pitted area gives a factor of safety below four.

From the formula for determining allowable working pressure

$$WP = \frac{TS \times t \times E}{R \times F}$$

where

WP = maximum allowable working pressure, lb. per sq. in.
TS = ultimate tensile strength of material, lb. per sq. in.
t = minimum thickness of shell plate, in.
FS = factor of safety
R = inside radius of shell, in.
E = efficiency of longitudinal seam

In this formula it will be noted that *E* represents the efficiency of the longitudinal seam. It is this efficiency which cuts down the allowable working pressure of a boiler shell and the weaker the seam the lower the working pressure permitted.

At the bottom of the shell where there is no seam, *E* in the formula may be considered as one or 100 per cent.

Solving the formula for *t*, we have

$$t = \frac{WP \times R \times F}{TS \times E}$$

Assuming the following values for the boiler in question and using *1* for the value of E:

t = 13/16 in.
FS = 4 = I.C.C. requirements

Assuming

R = 40 in.
TS = 55,000 lb. per sq. in.
WP = 230 lb. per sq. in.
E = 1 or 100 per cent

we have

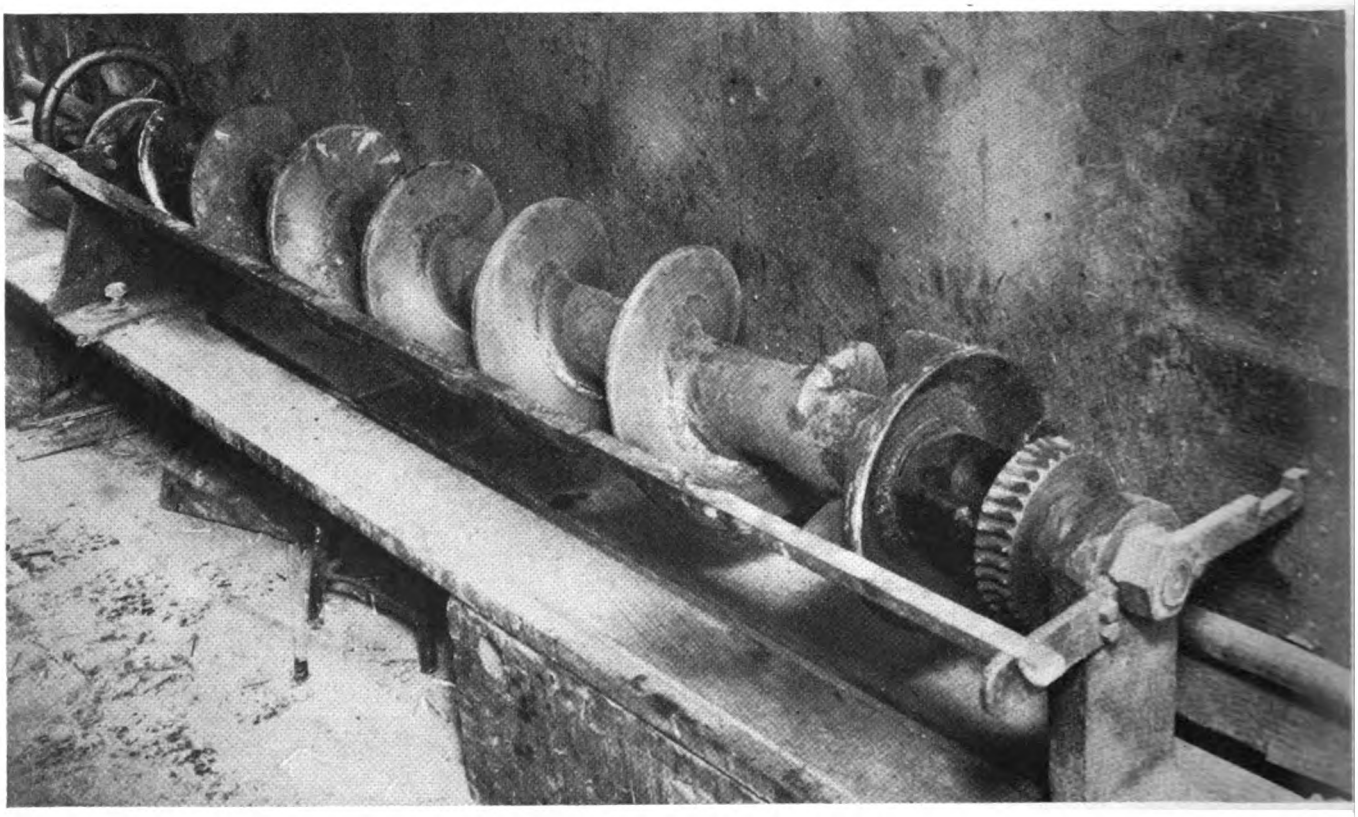
$$t = \frac{230 \times 40 \times 4}{55{,}000 \times 1} = .67 \text{ or } 11/16 \text{ in.}$$

Thus, the thickness of the shell through the pitted area, for the conditions assumed, to maintain a factor of safety of four would be 11/16 in.

13/16 in. — 11/16 in. = 1/8 in., the maximum depth of the pitting

The general practice for determining the strength of a pitted shell is to take the cross-sectional area of the shell through the pitted area and from this determine the factor of safety.

* * *

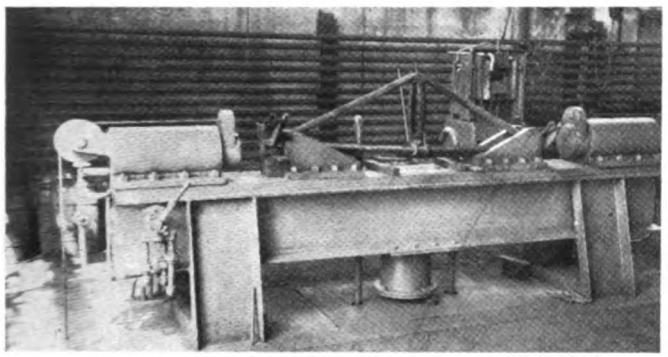


A jig for welding stoker elevator and conveyor screws in use at the Topeka, Kan., shops of the Atchison, Topeka & Santa Fe—The screw is built up to the straight edge, placed in brackets, and is ready for service without machining—A saving of one hour per screw is reported

With the Car Foremen and Inspectors

Brake Beam Repairs

Stripping of brake heads from solid truss type brake beams requiring repairs has been facilitated and considerably speeded at the Reading, Pa., shops of the Reading by the development of a hydraulic press. As beams

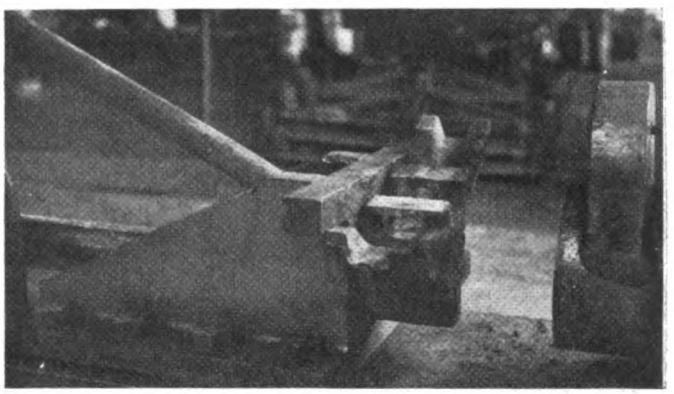


Brake-beam stripping machine in use at Reading shops

are received in the shop they are placed upon the table bed of the press with the fulcrum arm in a vertical position. In operation it is necessary to raise one end of the beam by putting a small block under it. This allows the opposite end of the beam to lie parallel with the table bed. While the beam is in this position it is thoroughly inspected to determine the extent of repairs needed.

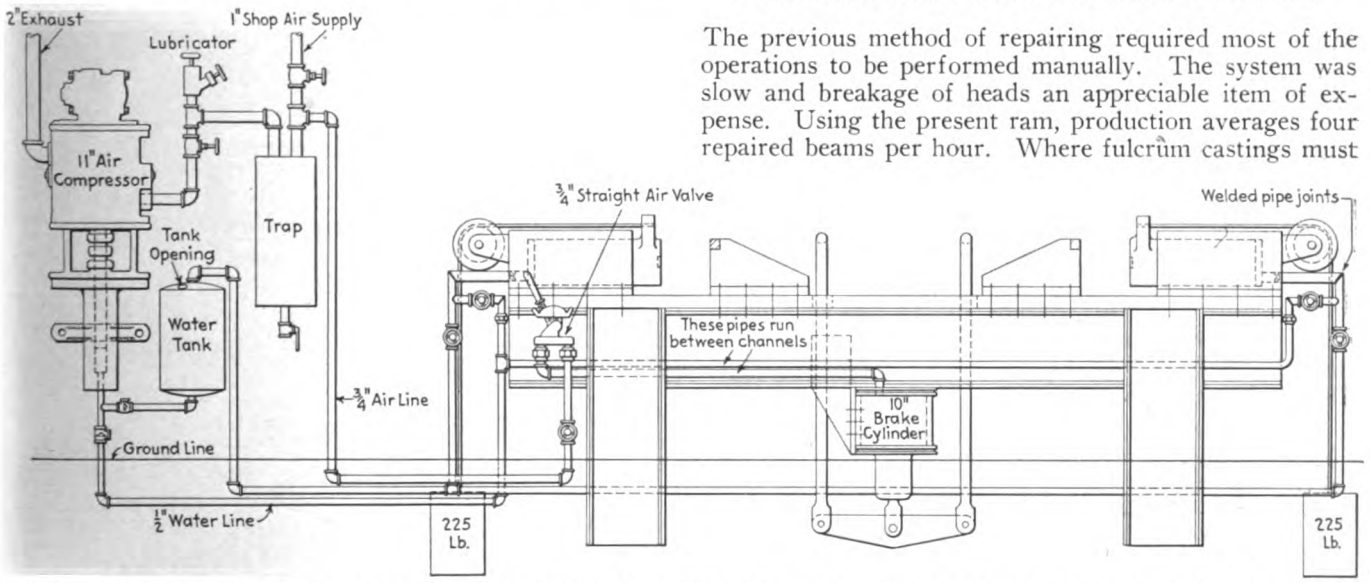
In removing the heads, a die shaped the same as the beam end but slightly smaller in overall dimensions is placed against the end of the beam which is flat on the table surface. This die is guided by a helper while the mechanic in charge of the press utilizes a pressure control valve to apply pressure slowly until the die has engaged the beam end and partially entered the brake head. Sufficient pressure is exerted by the cylinder to shear the rivets holding the brake head in place on the beam. Application of pressure is continued until the beam has been forced entirely out of the head. When pressure is released, the die is removed from the brake head and the operation is repeated on the other end of the beam.

The same press is used for applying new heads to beams. This operation requires that the beam be held rigidly in position. This is accomplished by air-operated clamps. Using the ram, new heads are forced on the beam and gauged to the required A. A. R. standard. Rivet holes are reamed and rivets, heated in an electric forge, are driven in the holes. Beams are then removed from the press to another table where, while they are held firmly in position in an air press, soft steel wedges are driven in the heads and trimmed with a cold chisel.

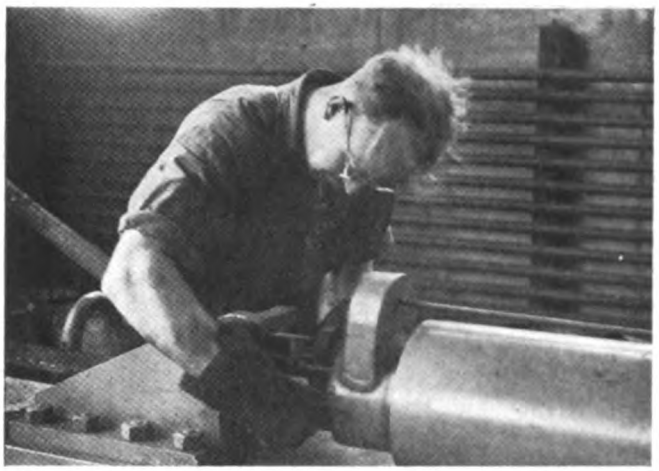


Beams are mounted in this position for removal of brake heads

The previous method of repairing required most of the operations to be performed manually. The system was slow and breakage of heads an appreciable item of expense. Using the present ram, production averages four repaired beams per hour. Where fulcrum castings must



Plan view of machine used by Reading Company for stripping brake heads from solid truss-type brake beams.—Functioning as a press the machine is also used in applying heads



Directing the die used in removing brake heads

be renewed the time per unit is increased by about fifteen minutes. Under the old system daily production for two men was from eight to twelve repaired beams.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

181—*Q.—What must be done to change the position of the contacts of relay 1?* A.—Their position can be changed only by energizing the relay in a direction the reverse of the previous energization.

182—*Q.—What is the status at this time of the three speed governor relays 2L, 2M and 2H?* A.—Current from the generator will also flow through wire *21*, contact *1-A*, resistor *8-L*, the upper coil of relay *8-L*, and resistor, *8-H*, and the upper coil of relay *2-H*. Therefore, all of the three speed governor relays *2L*, *2M* and *2H* are now connected to the generator and will operate at the proper speeds.

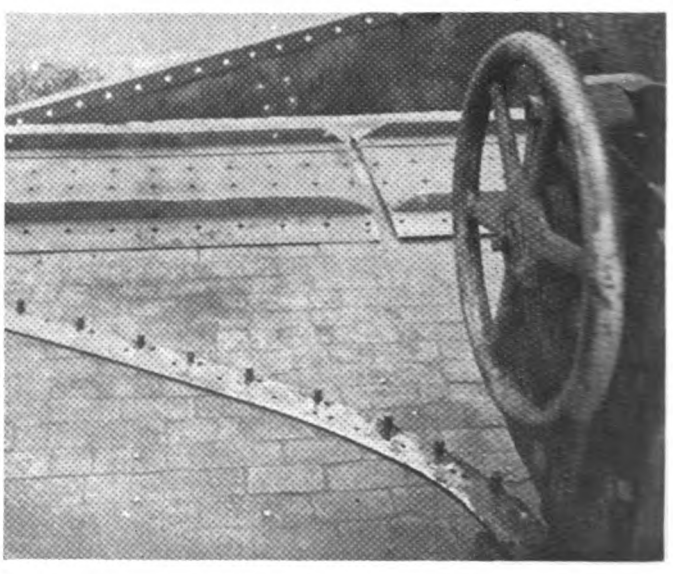
183—*Q.—When relay 5 was operated at a speed of approximately eight miles per hour, contacts 5-B and 5-C became closed. How, then, is the current flow?* A.—With contact *5-C* closed, current will flow from the positive side of the battery, wire *37*, contact *5-C* to indicating lamp *20* and through terminal *38* to the negative side of the battery. The lamp serves to indicate that the generator is functioning as intended. With contact *5-B* closed, and it being assumed that the *K-3* switch is closed, battery current will flow from terminal *45* through contact *5-B*, resistor *9*, the lower coil of relay *6*, contact *6-MF* and terminal *38* to the negative side of the battery. Relay *6*, therefore, assumes the energized position and, with contact *6-D* closed, battery current will flow from terminal *45* through contacts *6-D* and *6-MD* to the low-speed magnet *L* of the F.S. 1864 relay valve, which provides for 40 per cent maximum braking force.

184—*Q.—Describe the operation when a speed of 22 m. p. h. is reached.* A.—When a speed of 22 m. p. h. is reached, the generator current developed is sufficient to operate relay *2-L* to the energized position. Contact *2-LA* then becomes closed. The closing of the contact places a short circuit around relay *6*, which, therefore, drops to the de-energized position. Resistor *9* limits the current flow from the battery to the desired amount. When relay *6* assumes the de-energized position, contacts *6-A*, *6-C*, *6-D* and *6-E* become open and contact *6-B* becomes closed. The opening of contact *6-D* de-energizes the low-speed magnet *L* of the F.S. 1864 relay valve, thus providing 60 per cent of maximum braking force. The opening of contact *6-A* removes the short circuit around a portion of resistor *8-L*, thus increasing the amount of resistance in series with relay *2-L*. This increase reduces the current through the relay to such an extent that a slight reduction in the speed of the vehicle will cause relay *2-L* to assume the de-energized position. When relay *6* assumes the de-energized position a voltage is induced momentarily in the upper coil of this relay which causes current to flow to the lower coil of relay *2-L*. This current flow adds sufficient force to relay *2-L* to insure the positive closing of its contact.

185—*Q.—What happens when car speed exceeds approximately 43 m. p. h.?* A.—When the car speed exceeds approximately 43 m. p. h. there is sufficient current flow through relay *2-M* to cause it to assume the energized position, thus closing contact *2-MA*. The closing of this contact causes the battery current to flow from terminal *45* through contact *2-MA*, resistor *10*, lower coil of relay *6-M*, and terminal *38* to the negative side of the battery. Relay *6-M* then becomes energized. Induced voltages from the upper coil of relay *6-M* acts on relay *2-M* to insure positive closing of its contact as explained for relays *6* and *2-L*. Battery current now flows through contact *6-ME* to energize the medium speed magnet *M* of the *FS-1854* relay valve, thus developing 80 per cent maximum braking force. Contact *6-MB* is open, which increases the amount of resistance in series with relay *2-M*; thus insuring that this relay will assume the de-energized position if the speed is reduced to approximately 40 m. p. h.

A Short Cut For Layout Operations

Butt straps for gondola cars are accurately punched without templets or other layout operations at the Dunmore, Pa., shops of the Erie. A curved guide plate is fastened in place on a punch press and stops are located on the arc of the guide piece in such positions as insure



Guide pegs on a curved plate insure desired spacing between holes



A rotating guide keeps work pieces squared for punching

even spacing of holes both from the ends and sides of the work piece. One peg serves as an end stop, while the next peg nearest the punch serves to square the work. A rotating guide on the punch bed supplements the squaring action of the pegs.

Interchange Rules 70 and 98

Owing to the urgent need for conserving steel, the General Committee of the A. A. R. Mechanical Division, upon recommendation by the Committee on Wheels and the Arbitration Committee, has authorized revision of interchange Rule 70 and interpretation No. 4 to Rule 98, to permit substitution of one-wear wrought-steel wheels as correct repairs for multiple-wear wrought-steel, cast-steel and steel-tired wheels on freight equipment cars up to and including 70-ton capacity.

A circular letter, dated April 15, states that effective May 1, 1943, the above rule and interpretation are modified to read as follows:

Rule 70. (a) The following are wrong repairs:

1. Wrought-steel wheels (multiple-wear) substituted with cast-iron, cast-steel or steel-tired wheels, if car is stenciled "wrought-steel wheels."

2. One-wear wrought steel wheels substituted with cast-iron, cast-steel or steel-tired wheels, if car is stenciled "1-W wrought-steel wheels."

3. Cast-steel wheels substituted with steel-tired wheels, if car is stenciled "cast-steel wheels."

Substitution of cast-iron or one-wear wrought-steel wheels for cast-steel wheels does not constitute improper repairs.

4. Steel-tired wheels substituted with cast-iron or cast-steel wheels, if car is stenciled "steel-tired wheels."

5. Cast-iron wheels substituted with one-wear wrought steel, cast-steel or steel-tired wheels. (Car need not be stenciled "cast-iron wheels.")

(b) Wrought-steel wheels (multiple-wear or one-wear) may be substituted for cast-steel or steel-tired wheels, and the betterment charge is proper against car owner regardless of responsibility for the repairs.

(c) Double plate shall not be substituted for single plate cast-iron wheels. For the purpose of this rule a single plate wheel and a double plate wheel mounted on same axle shall be considered as a pair of double plate wheels, and charged and credited accordingly. Defect card is not required for such improper substitution. (See Rule 98, Section (c-4), for charges and credits.)

(d) The substitution of multiple-wear wrought-steel wheels for cast-iron wheels or one-wear wrought-steel wheels standard to car does not constitute improper repairs. If such substitution is made, however, account owner's responsibility, the charge is to be based on A. S. R. prices but in no case to exceed A. A. R. prices for new cast-iron wheels or new one-wear wrought-steel wheels standard to car.

(e) The substitution of one-wear wrought-steel wheels for multiple-wear wrought-steel wheels, cast-steel wheels or steel-tired wheels does not constitute improper repairs, except on passenger equipment cars, freight cars equipped for passenger train service, or freight cars of over 70-ton capacity.

(No change in interpretation Nos. 1, 2 and 3.)

Rule 98. Interpretation No. (4) Q.—What method should be used in charging for cast-iron wheels or cast-steel wheels when applied in place of multiple-wear wrought-steel wheels standard to car?

A.—In case of owner's defects: Charge should be made against car owner for the wheels applied on basis of secondhand value of cast-iron or cast-steel wheels (irrespective of application of new or secondhand cast-iron or cast-steel wheels), journal bearings, journal wedges, box bolts and dust guards, when renewed, as well as the labor R. & R. Credit will be allowed for value of wrought-steel wheels removed on basis of full flange contour, less labor cost of turning when necessary. Defect card to be applied for the wrong wheels.

In correcting these repairs on authority of defect card the owner should bill for the labor and not value of journal bearings, journal wedges, box bolts and dust guards, if renewed.

In case of delivering line defects: The above ruling applies except that no charge should be made against owner for journal bearings, journal wedges, box bolts, dust guards, and labor R. & R., nor labor for turning the wheels removed when occasioned by delivering line defects on same; credit to be allowed car owner for entire loss of service metal due to same cause.

Note.—The same principles apply in the case of cast-iron wheels substituted for one-wear wrought-steel wheels, except that credit for the wheels removed shall be allowed car owner on basis of prices per Rule 101; no charge for turning.

The same principles also apply in the case of cast-steel wheels substituted for one-wear wrought-steel wheels, except that charge for wheels applied shall be on basis of their secondhand value, while credit for the wheels removed shall be allowed car owner on basis of prices per Rule 101; no charge for turning.

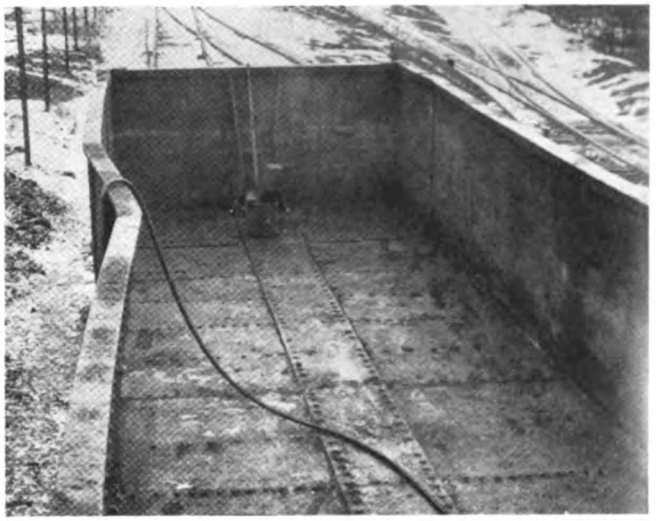
Note.—Secondhand double plate cast-iron wheels substituted under any of the above conditions shall be charged at scrap value.

These modifications will be included in the first supplement to the current code.

Top-Rail Straightening Device

Top rails on open-top equipment which have been bent in service are straightened in place quickly and at minimum cost at the Dunmore, Pa., shops of the Erie. The work is performed by the use of a compressed-air operated jam riveter which has been converted into an effective straightening device. A special head, a solid metal

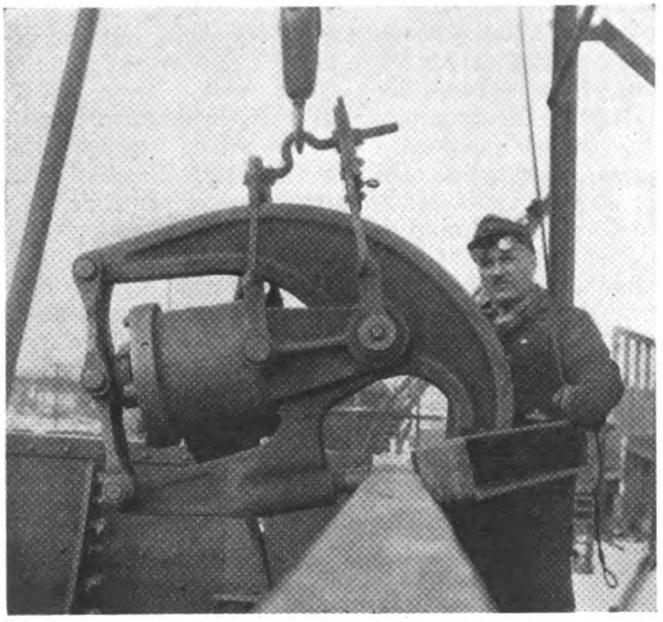
block built up slightly on the ends by welding, was applied to the riveter and this is placed against the concave surface of the bent portion of the angle to be straightened. When air is admitted to the cylinder the plunger of the riveter forces the angle against the special block-



An example of the type of damage repaired with the top-rail straightener

ing head. The built-up ends of this head compensate for the slight springing action which would occur when the pressure is released.

Small kinks are straightened with only one or two positionings of the unit; larger deformations require a series of applications before the angle is completely straightened. The straightener can be operated in either a horizontal or a vertical position and any angle which



Top-rail straightener in position for use

has not been cracked or broken through can be straightened. The time and material saving over the method of removing top rails, straightening them in a shop press, and replacing them represents a total of approximately $12.00 per car. Two men are required to do the work; they are able to keep pace with the repair schedule of the shop and have time for other miscellaneous stripping operations. Most of the straightening is done cold, only rarely is it necessary to heat an angle to remove a complex or unusually sharp bend.

The straightening unit is suspended from an air hoist which travels on an overhead beam which, in turn, moves on rails mounted on steel columns which are parallel with the track. It can be spotted at any point on the car and height adjustments are made by raising or lowering the air hoist. By means of this hoist the unit is raised clear of the car after operations have been completed.

Several thousand cars have now had top rails straightened in place.

Lubrication Of Journal Boxes*

By H. J. Flannigan†

In the several years I have been employed as a car oiler on the Illinois Central, various freight-train lubrication practices have been followed, but the present method seems to be producing more beneficial results than any previously employed. This practice may be described briefly as follows:

Immediately upon receipt of a cut of cars delivered to us in interchange or immediately upon arrival of a train off our road, two oilers, one on each side of the cut or train, raise the journal-box lids and by placing the bare hand on the collar of each journal check the temperature. By comparing the temperature of each journal of the same car, we are able to tell if these journals are running in trouble-free condition. If any of these journals is operating at an abnormal temperature, that is, warmer than is consistent to the car, and the reason for this is not immediately detectable, that car is placed on a certain specified track and is jacked up and given a close inspection, so as to determine the cause for that journal becoming overheated.

In the same operation these two men check the journal bearings for waste grabs, run-over bearing lining, thin, loose, worn-out or cracked babbitt, excessive end wear, cracked or broken bearings, lugs of bearings broken or missing, etc. If any of these defects is found it is marked on the side of the car, to be taken care of by two men following behind them, adjusting packing to the proper position, replacing packing that contains any grit or dirt, and adding oil to the journal boxes having an insufficient amount to assure correct lubrication of the journal. After these cars are placed in correct running order, they are marked on the side with chalk indicating they are in condition to continue safely toward their destination.

Stationed at advantageous and easily accessible places throughout the train yards are new journal bearings, wedges, correctly prepared packing and new car oil to be used when bearings or wedges need replacing, or a journal box needs more packing or a little oil. There also is a mixture of flake graphite and car oil that is applied on the bearing surface of all bearings applied.

Due to impacts received while being switched about the train yards, the cars are given another check after being placed in trains, just before departure, inspecting particularly for waste grabs which are caused most frequently by impacts of the cars, and readjusting packing which has been disturbed. In general, we make doubly certain that the cars are in condition so far as concerns

* Short paper which was awarded first prize in the annual competition by the Car Department Association of St. Louis for the best paper of this type presented during 1942.

† Carman helper, Illinois Central.

lubrication to insure successful operation over the road.

Experience has taught that the best results will be obtained when journal boxes are repacked as follows:

First: A small portion of packing is slightly twisted, with the ends turned under, and firmly placed in the back of the journal box, for the purpose not only of retaining the oil, but to exclude the dust. The ends of this portion must not extend higher than an inch below the center line of the journal.

Second: A sufficient amount of packing is placed in the box, preferably in one piece, to fill the space under the journal firmly, so as to prevent settling away, taking care to have the packing bear evenly along the full length of the lower half of the journal. This is best accomplished by placing the packing across the full width of the mouth of the journal box, allowing the strands to hang down outside, always adding more packing before placing the hanging strands inside the box. This has the effect of binding all of the packing into one mass. The top of the packing should be one inch below the center line of the journal along the sides to prevent waste rolling under the bearing. By placing the packing under the journal until the front or outer edge of the collar is reached, the packing presents an inclined surface toward the front of the box. No loose ends or threads should protrude at the side or ends, such ends being carefully tucked under the sides of the packing; nor should any piece of packing be laid along the side of the journal, as such pieces may become caught under the bearing, causing a hot box.

Before applying or replacing a journal bearing, be sure it has been thoroughly cleaned and has a thin coating of a mixture of car oil and graphite. When cleaning a journal bearing, use a clean cloth or shop towel, never wipe the surface of a journal bearing with waste. A preliminary fitting of the bearing to the journal, using a mixture of car oil and lampblack, assures a much better fitting and eliminates a portion of the breaking in period through which every new journal bearing must go to achieve a perfect fit to the journal.

When applying the wedge on top of the journal bearing, see that it is properly seated on the crown of the bearing, so as not to pinch the side of the bearing, nor rest on the lugs, also before re-applying a wedge, gage it, being sure it has not become flat on the top and that it is still the correct length.

Trim Bearings To Give More Reliable and Longer Service

Any bearing applied to a journal should be perfectly fitted to insure safe operation. New bearings, when applied to journals are not perfectly seated due to slight variations in size of journals and of the bearings. To enable bearings to reach a full seat, they are lined with a soft babbitt which flows to conform to the radius of the journal after it is in service for sometime. This settling pushes excess babbitt over the edges of the bearing, causing trouble in three ways.

First: It prevents flow of hot oil away from the journal and bearing at the edge of the bearing.

Second: It causes oil to flow out on the axle and wheel at the rear of the journal box which in time leaves the packing in a dry condition.

Third: It allows lint from the oil to build up under the over-run babbitt, shutting off oil to the journal.

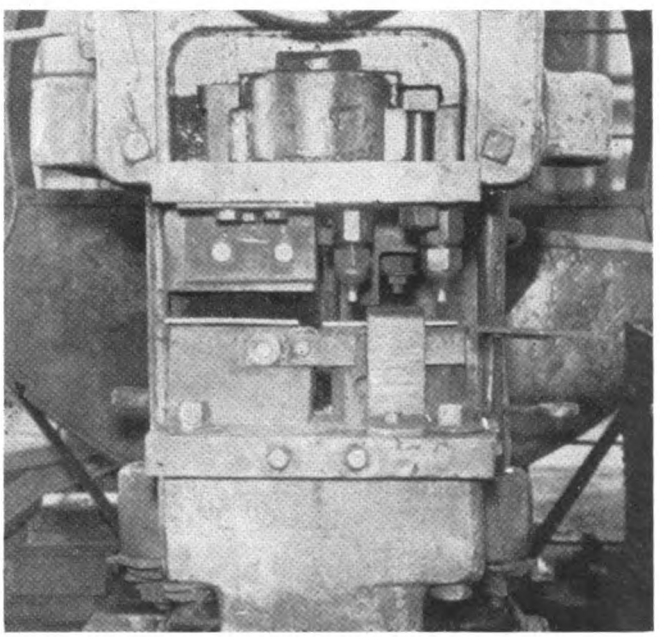
All such bearings operate at abnormal temperatures, many of which cause failures. The great majority of these bearings are not worn out, but are in fact only properly seated and would give many months of trouble-free service, except for the run over condition.

A. A. R. standard rules provide for the replacement of such bearings. In tests made at the time of periodic repacking of cars, proof was obtained that 74 per cent of the bearings replaced were on account of this run-over condition. This means a tremendous loss, as new bearings applied must necessarily go through the same break-in period and be discarded in the same way long before they are worn out. Tests also showed that 43.2 per cent of total bearings in operation are in partially run-over condition but not sufficient to call for replacement, nevertheless, each represents a potential failure.

By use of a special machine designed to trim the edges of the babbitt and reshape the original oil groove, such bearings, as are condemnable due to this run-over condition, are put back in service and give many more months of trouble-free service. This trimming of bearings is done at the car, each bearing being replaced to its original journal on which it has acquired a full seat. This reduces operating temperatures as much as 100 deg. F. in some instances and puts all the bearings in condition to operate at normal temperatures and increases the life of them from four to nine times, as proven by tests. This is a tremendous saving to the railroad in the purchase of bearings alone and an even greater saving in operating expenses.

Speeding Machine Output

The punch illustrated has been made to perform two operations at the same time by setting up special dies for punching and offsetting floor clips for wooden floors in gondola cars. Used at the Dunmore, Pa., shops of the

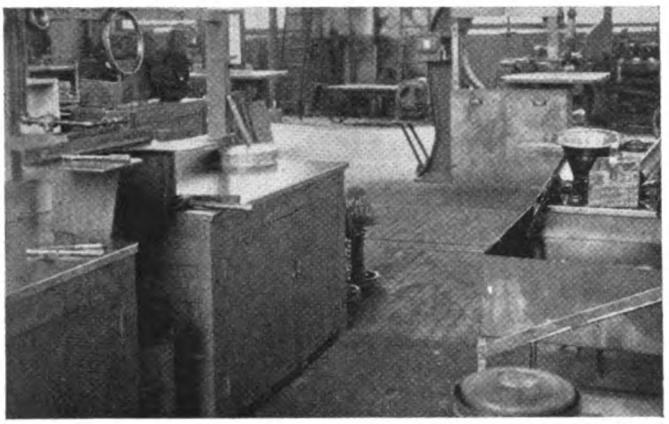


Two sets of dies permit punching and offsetting floor clips in one operation of the press

Erie, this has halved the time required to make these clips. The dies to the right punch the required two bolt holes while those to the left are putting the needed offset in the clips. Steel, cut to size, is first punched and then offset.

Cleaning AB Cylinder Pistons

The A. A. R. code of interchange rules provides that the cleaning, oiling, testing and stenciling of AB freight brake equipment shall be performed in accordance with the provisions of Rule 60. The procedure to be followed is further defined in the Standard of Instructions for Maintenance of Brake and Train Air Signal Equipment.

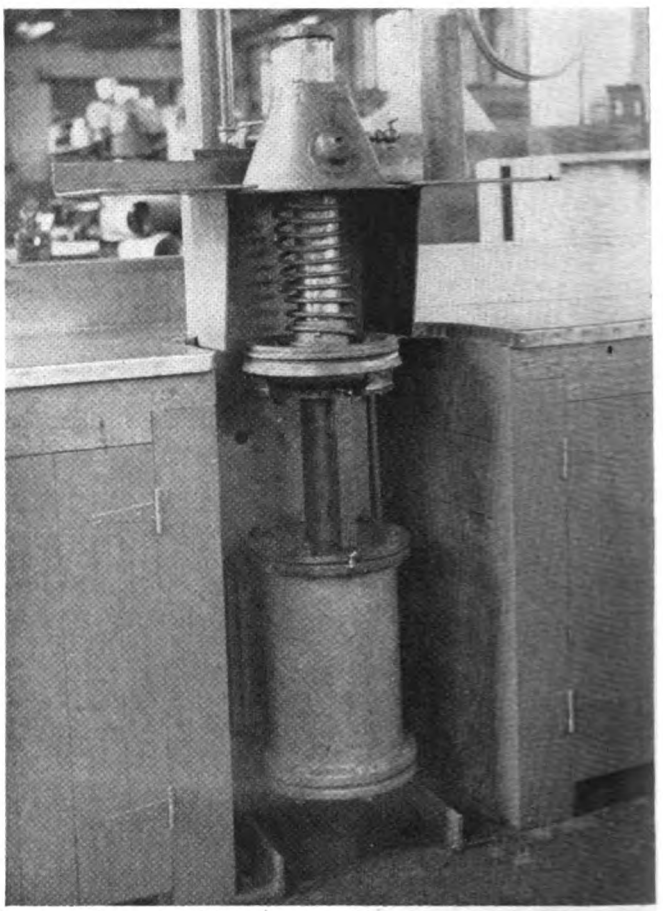


Work benches, stripping rack and cleaning tank are arranged to facilitate operations and speed the cleaning of pistons and associated parts

Instructions for the reconditioning and testing of brake-cylinder pistons and associated parts require that they must be delivered to a suitable shop for reconditioning and that adequate protection against damage and contact with dirt must be provided in handling to and from cars.

The Delaware & Hudson has installed facilities at Colonie, N. Y., and Oneonta and at Carbondale, Pa., for performing this work. The photographs are of the installation in the car shop at Colonie. Necessary equipment and work benches are installed in a well-lighted shop and are so arranged that a minimum amount of moving about is required of the mechanic on the job. The stripping rack is located in a recess in the work bench; the work bench, itself, is covered with a rust-resisting metal top which is easily cleaned and kept free of dirt, oil and grease. A special rack used in removing and applying felt swabs to the retaining rings is located at one end of the work bench. This rack holds the ring firmly in place and can be rotated as the swab is applied. Before this rack was developed it was necessary for the workman to hold the ring in one hand while applying the swab with the other. Using the rack, both hands are free for work and swabs are easily applied.

The stripping rack is so built that a working surface

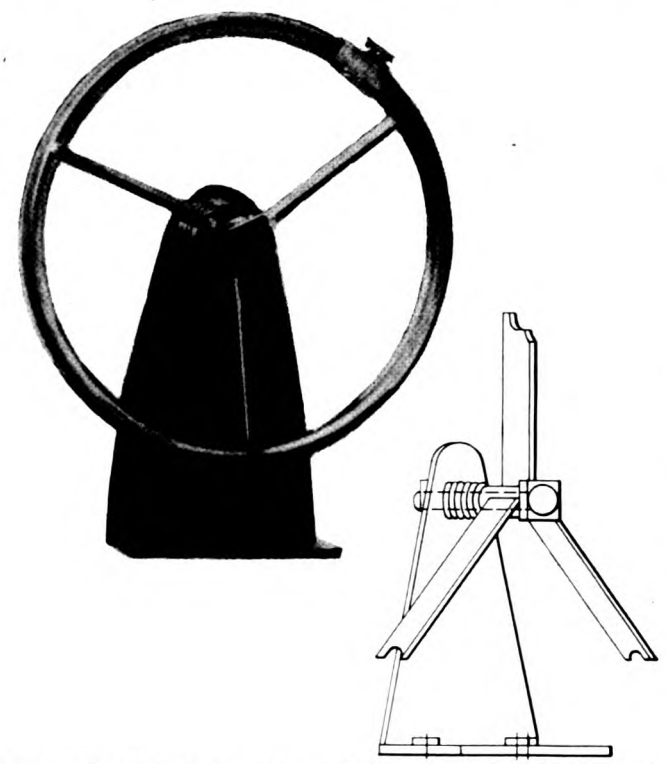


A cylinder in position on the stripping rack—The shelves provide a handy resting place for needed tools—Reassembly of parts is also done on this rack

is provided on each side of the cylinder by extending the holding plate to form shelves for tools. Parts are wiped clean before immersing them in the cleaning solvent. Small parts are collected in a wire-mesh basket to avoid loss or the necessity for "fishing" in the solvent tank.

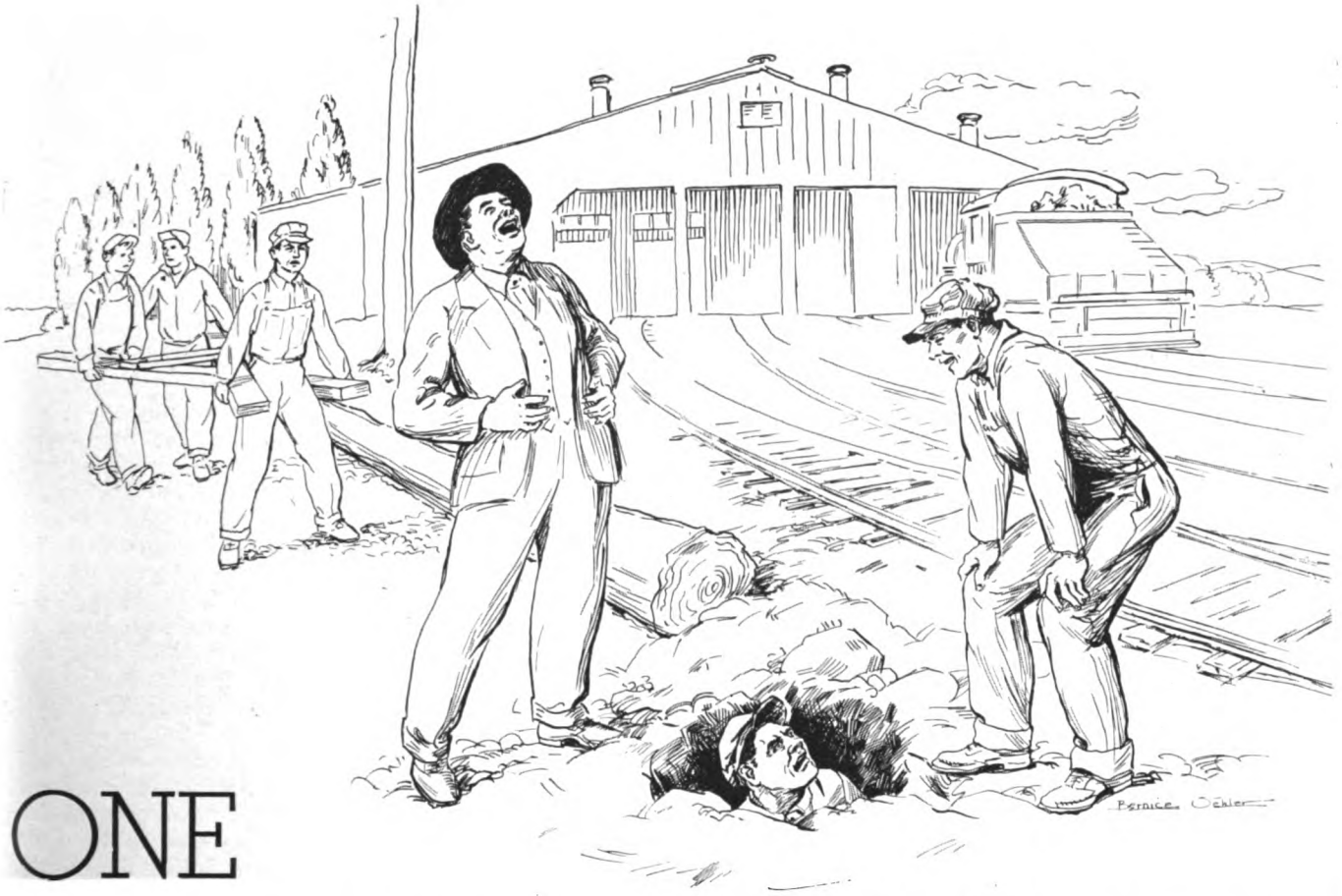
The solvent used conforms to the specifications given in Instruction Leaflet No. 2391, Supplement of December 1, 1942. It is renewed at intervals which assure clean oil at all times. After all parts have been soaked in the solvent and thoroughly cleaned by brushing they are allowed to drain. When dry they are reassembled, after careful inspection, in the same rack which was used to strip the cylinder.

Cleaned and renovated cylinders are kept in storage cupboards beneath the work bench. When required for application to a car they are placed in covered galvanized metal containers and carried to the point where needed.



Felt swab retaining rings are mounted on this rack while the swabs are being removed and renewed

ELECTRICAL SECTION . .



Johnson found Sparks and the section foreman laughing so hard they had tears in their eyes

ONE EYE BLIND

By Walt Wyre

THE S. P. & W. railroad like many other industries is suffering from labor shortage. Installation of automatic controls on boilers, well motors and water treating plants has helped somewhat to solve the problem and will do more when and if material for other installations is obtained and mechanics find time between maintenance jobs to do the work.

The automatic control on the fuel oil heating boiler worked so nicely that similar equipment was immediately ordered for Middleton. The system water service supervisor ordered the equipment consisting of a motor-operated burner, motor-driven boiler feed pump, water-level control, electric-eye safety device, and necessary panel boards, relays, pressure switch, etc.

Ned Sparks, electrician for the company at Plainville, ordered the necessary wiring material for installing the equipment.

Installation of new equipment on the Plains Division, together with additional maintenance, added so much electrical work on the division that two electricians and a helper had been added to the force. H. H. Carter, the master mechanic, had asked for four electricians, but they told him he was lucky to get two.

One of the new men was assigned to the roundhouse. Sparks and an electrician named Johnson spent most of their time on the new work and outside maintenance over the division.

Material for the job at Middleton came sooner than expected and as usual the division engineer was in a rush to get it installed. Sparks and Johnson were in Sanford at the time installing a motor on a water pump to replace an antique oil engine that was in good condition to drop on Tokio. The well was located some distance from a power line and it was necessary to set four poles and run three spans of wire in addition to wiring for motor and controller.

The two electricians finished running conduit and connecting in two days. Johnson was taping the motor leads when Sparks remarked, "Sure having nice weather; it will about turn off bad when we start on the line tomorrow."

NEXT morning Johnson looked out the hotel room window, swore softly, then picked up a shoe and threw it at a bulge in the cover where Sparks lay in bed.

"Hey!—what the hell!" Sparks yelled and rubbed his rear. "What's the big idea!"

"That's for being a better weather prophet than an electrician," Johnson replied from behind the pillow he was holding as a shield in case of a counter attack.

A fine mist was falling from a heavy canopy of low

hanging black clouds that threatened to gush at the first jar. The rain, freezing as it fell, had glassed over side walks and pavement with a slippery coating.

"Well, it worked out about as usual," Sparks remarked glumly. "Nice weather for the inside work and vice-worser for the outside."

Johnson groaned at the punk pun and slid out of bed.

A laborer had already dug holes for the poles the day before and Sparks had made arrangements for the section gang to help set them. When the electrician reached the roundhouse they found the section foreman and three men standing by a fire they had built outside near where the line was to be run.

"Why didn't you wait in the roundhouse where it's dry?" Sparks asked.

"Never thought of it," the section foreman replied, then added, "I've only got three men; two didn't show up and I had to send one out in the yard to clean switches."

"It's going to be quite a job setting forty-foot poles without more men," Sparks said, "but guess maybe we can make it. Johnson, will you take a couple of men and go over to the rip track and get some timbers to make an A frame? We'll sure need one. I'll see the roundhouse foreman; maybe he will let the laborer that dug the holes help us set the poles."

After a bit of grumbling about being short-handed, the roundhouse foreman agreed to let the laborer help until noon. "You'll find him cleaning pits in the south end of the roundhouse," the foreman said.

"What do you want me to do?" the laborer asked. "Dig some more holes."

"You didn't get the ones you dug yesterday deep enough," Sparks said as the two men left the roundhouse.

"Looked to me like I dug them six feet like you said," the laborer argued. "I didn't have a measure."

"Well, you are nearly six feet tall," Sparks said soberly. "You might get in one of the holes and if it's a little over your head it would be about right."

Sparks walked over to the fire where the section foreman was standing. Just then he heard a muffled yell. He and the section foreman looked around. The laborer had disappeared, but the yelling continued.

Johnson and the two section men returned dragging a heavy A frame and found Sparks and the section foreman laughing so hard they had tears in their eyes.

"What in the hell is so funny?" Johnson wanted to know.

Sparks pointed to the laborer standing in the six-foot hole and unable to get out. The man was swearing heartily.

"I was kidding when I told him to jump in the hole to measure it," Sparks explained.

They lifted the laborer out of the hole. Sparks had to do some fast talking to keep from having to fight or run, but the man finally cooled off and laughed with them.

It was a mean job setting the ice covered poles and dangerous, but they managed to get it done by noon and without hurting any one. It was slightly warmer than it had been earlier, but it was raining harder.

"Is that all for us?" the section foreman asked hopefully.

"Not quite," Sparks replied. "We'll need holes for a couple of guy anchors, one at each end of the line. I'll show you when we get back from lunch."

Sparks was making up a guy wire when the roundhouse foreman came up and said, "They want you at the passenger station. There's something wrong with the electric water cooler."

"Maybe I had better go with you," Johnson suggested.

"Never mind," Sparks grinned. "If it gets to raining too hard, take an umbrella up the pole."

SPARKS found the electric water cooler apparently operating O.K., but the water was warm. He pressed the valve and allowed the water to run about a minute. If anything, it got warmer.

"It's been acting this way right along," the agent explained. "Sometimes the water is cold as ice, then again it's almost hot enough to make coffee."

Sparks took the plate off the back of the cooler. Everything seemed to be operating perfectly. The cooling coils were enclosed and it would be quite a job to get to them. The condenser seemed to be slightly warmer than normal, but that could be accounted for by the fact that the compressor had been running continuously.

After about an hour spent examining the cooler, Sparks was ready to give up. He was replacing the back cover when the agent came out and wanted to know how he was getting along.

"Not so good," Sparks told him. "I can't find anything wrong except it doesn't cool. The water is actually hotter than it should be without any cooling."

"Seems like the water is warm just on cold days," the agent said. "Yesterday it worked fine all day."

"Maybe you've got something," Sparks commented. He felt of the water pipe coming into the cooler. "Why it's hot as a steam pipe!"

Sparks finished replacing the back on the cooler, then went down into the basement. After a few minutes looking he found why the water was warm on cold days and cold on warm days. The supply pipe to the cooler was connected into the pipe that supplied the heating boiler. Evidently the check valve was leaking, because the pipe was just as hot on one side of the check valve as the other. On cold days when steam pressure was kept well up, the water in the supply line became hot.

"No wonder that little compressor was running itself to death trying to cool boiling water," Sparks told the agent. "It'll be O.K. when the valve is renewed or the water pipe changed."

JUST before quitting time that afternoon, a cold wind blew the clouds away and the rain stopped. Johnson, wet as a dunked doughnut and grouchy as a cat with a sore tail, complained all the way to the hotel. After a hot bath and change of clothes, he felt better. The next day was clear and somewhat cold, but not enough to be very disagreeable. The electricians finished the line by working an hour overtime and tried the pump motor. It worked O.K. and, for a wonder, ran in the right direction. They caught the night train returning to Plainville.

Next morning at eight o'clock the division water service supervisor came to the electric shop. "We are moving the fuel oil cranes over to the main line," the water service supervisor said, "and I want to get started today."

"I suppose they'll want controls on the cranes and lights over them," Sparks said.

"That's right," the water service man agreed. "I thought I'd tell you so you can get your material together. We are going to keep one of the old cranes in service until the new ones are ready."

"What about the automatic controls on the boiler at Middleton?" Sparks asked. "I thought you were ready for that."

"Oh, we managed to get that going. One of the signal men and a water service mechanic did the wiring. Did a nice job, too, except there wasn't enough conduit to run to the electric eye tube. You had better look at it when you get time. It works O.K.," the water service man added. "If you've got time, I'll show you where the oil cranes are to be located."

"Well," Sparks commented, "we have enough poles to run the line wires and perhaps enough secondary rack. All we need is about 1500 feet of number 8 weatherproof, 300 feet of underground cable, some conduit, a few fittings, and we would be all fixed up for the control lines. We have enough rubber covered 14 to do the wiring on the cranes. Of course, there is still the material for lights to be considered."

"Well," the water service supervisor replied, "that's not my worry. I've got about 400 feet of 1-inch single strength galvanized pipe you can use for conduit, if it will help. It was ordered for a water line to a section house, but we are not going to put it in."

After considerable picking up and patching and by taking down a light line to one of the pumphouses, Sparks found sufficient material to run the control line, but he still needed something to go under the tracks to the cranes.

"How about rubber covered wire in that galvanized pipe?" Johnson suggested.

"Don't like it!" Sparks replied shortly, "but I guess it's the best we can do."

IT TOOK Sparks and Johnson eight days to run the control lines and do the wiring on the first oil crane. The second crane wouldn't take much time. After consulting the master mechanic, it was decided to use the lights at the old cranes for the new ones.

Sparks and Johnson were taking down the lights preparatory to changing them to the new location when Jim Evans, the roundhouse foreman, came up. "There is something wrong with the electrical equipment in the boiler room at Middleton," Evans told Sparks. "One of the water service men will take you in the truck."

"I'll be ready in thirty minutes," Sparks replied, "at the electric shop."

Sparks got his tools together, some wire, tape, etc., that he thought might be needed and was ready to go. Then he remembered about the line to the electric eye tube not being in conduit. No use leaving wiring for lights in the wellhouse, with no line running to it, he thought, so he rushed out and took down a couple of joints of half-inch conduit.

The three men; a water service man, Johnson and Sparks were soon on their way to Middleton.

"Looks like a fairly nice job of running conduit," Johnson remarked when they were in the boiler room.

"Must have buried it fairly deep in the floor," Sparks said. "See, it comes up straight out of the concrete."

A little later on they found out to their sorrow how and why the nice straight runs of conduit.

A little testing showed that wires in the ¾-inch conduit from the boiler controls to the instrument panel were grounded and shorted. "Guess we'll have to pull them out," Sparks said.

There were seven number 12 wires in the conduit. The two electricians each tried to pull any one of the wires without any luck. Then they both pulled together, but the wires wouldn't budge. They fastened a piece of galvanized wire to the seven wires tied together and tried pulling with a small chain hoist. The galvanized wire broke.

"Guess we'll have to dig the conduit out of the floor," Sparks finally said.

"That's going to be quite a job without an air gun," Johnson growled.

They started in with cold chisel and hammer pecking away at the concrete. In about two hours they found why the wire wouldn't come out of the conduit. Where the conduit went into the floor, there was an LB Condulet buried in the concrete. Then at the boiler there was a T with an LB together buried in the concrete floor.

"Well, I'll be damned!" Sparks exclaimed. "Now I've seen everything!"

The water service man who had been doing some work outside on a steam line came in to see how the electricians were making out.

"Were you here when this wiring was done?" Sparks asked the water service man.

"Yes—I helped with it. Why?"

"Well, tell me how in the thunder did you get the wire in that conduit after it was laid in the floor!"

"Oh," the water service man replied, "we put the wires in the conduit before it was laid in the floor. Quite a job, too."

It took Sparks and the other electricians three days to dig the conduit out and rewire the boiler controls. They also ran conduit from the panel to the electric eye tube. There were only two wires in that conduit, they were heavily insulated ignition wire.

WHEN the job was finished, the pumper, who also tended the boiler, lighted the fire. The pilot came on O.K., but the fuel oil valve wouldn't open. The relay operated by the electric eye tube wasn't closing. Sparks adjusted the potentiometer until the relay closed and the oil valve opened and the fire lighted.

"Guess we had better test it to see if it will cut off," Sparks suggested.

The pumper found a piece of cardboard cut to fit in the electric eye tube receptacle. He inserted the cardboard cutting the light to the tube. The fire didn't go out as it should.

Again Sparks adjusted the potentiometer and the fire went out, but wouldn't relight. "Guess you'll have to operate with hand control tonight," Sparks told the pumper. "We'll find out the trouble tomorrow."

Sparks and Johnson worked and worried all next day without learning why the apparatus wouldn't work properly. They tried new tubes, various adjustments of relays and tested wiring without finding any apparent cause.

About three o'clock in the afternoon, the pumper brought Sparks a message saying that the pump motor at Sanford kept stopping and for him to see about it soon as possible.

About five o'clock the electricians held a consultation and decided that there was something wrong with the relay, potentiometer, resistor or other gadget they weren't prepared to test and gave up for the time being. They caught the seven o'clock train about ten o'clock and went to Sanford.

A voltmeter soon showed why the well motor controller was kicking out. The line to the well was connected to the power line to the turntable. When the turntable motor controller was pushed around quickly, the resulting voltage drop caused the well motor controller to kick.

"Well, that's that," Sparks commented. "It'll take

(*Continued on page 288*)

Cold Cathode Lighting

Some engineering data for comparing the two types of fluorescent lamps

UNTIL very recently, the use of cold cathode fluorescent tubes has been limited almost entirely to signs and decorative lighting. A few general lighting installations were made, but lack of performance data made the results somewhat unpredictable. Such data was recently made available by A. C. Barr* and C. M. Cutter† and presented before a joint meeting of the Illuminating Engineering Society and the Illumination Group of the American Institute of Electrical Engineers at New York. Excerpts from the paper follow:

The function of the cathode in both cold- and hot-cathode lamps is the same; that is, to give up electrons which, together with the ions they produce, carry the arc current. The cold cathode operates at about 150 deg. C., while the hot cathode reaches 900 deg. C. The hot cathode is the more prolific emitter because the rate of emission of metals, particularly the alkaline earths used for coating cathodes, increases tremendously when the metals are heated to incandescence.

The very high emission rate per unit area of the hot cathodes give it some favorable characteristics. Three important ones are small size, low voltage drop and relatively high current-carrying capacity. These are obtained at the cost of cathode life, since hot operation is a result of using a cathode wire size small enough to heat up at the current the lamp carries. Being small, the amount of emission coating is limited. This factor, combined with the faster use of the emission material at the higher-temperatures, tends to limit life.

On the other hand, the emission rate of the cold-cathode is low, and large area is needed to handle satisfactory currents. Life can, therefore, be very long and little affected by starting. These characteristics are also obtained at a cost, this being high voltage drop and limited current-carrying capacity.

To summarize, hot- and cold-cathode sources are similar except for their electrodes. These differ in that the hot cathode can handle much higher current and has a lower voltage drop, while the cold cathode, although less favorable in these characteristics, is less affected by starting and has substantially greater life.

The higher current-carrying capacity of the hot-cathode electrode enables the lamp designer to obtain more light per foot either by increasing the current in the same diameter tube or by increasing both the current and the diameter.

When the current is increased in a given tube, current density increases. The same area of phosphor surface is exposed to an arc of greater intensity, therefore the surface is brighter and more lumens per foot are produced. However, high current densities have some disadvantages: a smaller proportion of the phosphor exciting radiation is produced and light output is not so well maintained.

A better way of increasing light output is to use both larger diameter and higher current. Three things happen when the tube diameter is enlarged. First, the cross-sectional area becomes greater in proportion to the square of the diameter. Second, the inside wall of the tube, on which the phosphor is coated, increases directly with the change in diameter. Third, the voltage drop per foot of arc column is reduced.

Comparing a 20-mm. cold-cathode tube, operating at 100 ma. and a 1½-in., 40-watt hot-cathode lamp at 400 ma. illustrates these effects. The inside diameter of the cold-cathode tube is about 18 mm., so its current density is 0.4 ma. per mm.²

$$\text{Current density} = \frac{\text{current}}{\text{cross-sectional area}} = \frac{100}{\frac{1}{4}\pi 18^2} = 0.4$$

The 40-watt lamp has an inside diameter of approximately 36 mm., so its current density will be the same.

The area of phosphor for a given length is also in relation to the diameter, or in this case 18 to 36. The actual area would be π times inside diameter times length.

For this example, the drop per foot of arc column is found to be 50 volts for the cold-cathode tube, and 25 volts for the hot-cathode lamp.

Thus, with equal arc intensity, twice as much phosphor is exposed, while the voltage drop is reduced one-half. The net result is twice as much light and twice as much wattage, so the efficiency is the same except for the watts loss at the electrodes.

The lower voltage drop at the hot cathode allows the use of conveniently-short lengths of tubing without absorbing a high percentage of the tube volts at the electrodes. Fig. 2 shows this effect for electrodes ranging in voltage drop from 15 volts to 150 when used with 20 mm. tubing operating at 100 ma. The 15-volt drop is typical of hot cathodes, while 100-, 150- and 200-volt drops are representative of various types of cold-cathodes.

The charts show that the lower the electrode drop, the smaller the percentage of voltage lost at the electrode for any given tube length.

If hot cathodes are used on a 4-ft. length of this tub-

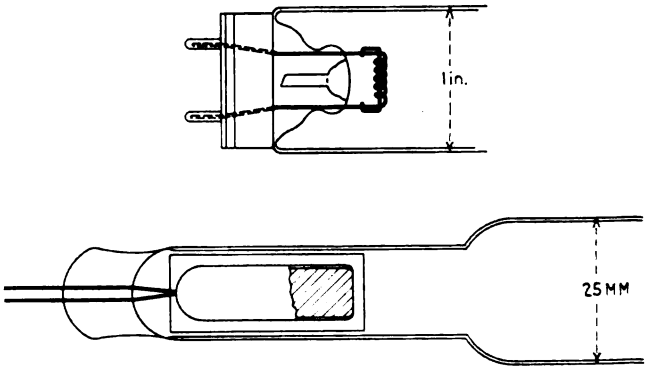


Fig. 1—A Mazda F hot cathode terminal is shown above and a typical cold cathode terminal below

* Glass Technology Laboratory, General Electric Company, Cleveland, Ohio.

† Nela Park Engineering Department, General Electric Company, Cleveland, Ohio.

ing, the drop at the electrode will be 7 per cent. If a 10-ft. length of this same tubing is equipped with cold-cathodes, this loss will be 17 per cent for a drop of 100 volts and 23 per cent for 150-volt electrodes.

It should be noted, however, that the difference in absolute value of cathode watts loss, in general, is much less pronounced because the high cold-cathode drop is accompanied by a lower order of current. For example, the 40-watt hot-cathode lamp operates at 410 ma., therefore, watts loss in the cathode drop is 0.410 times 15, or 6.15 watts. In cold cathodes, these figures might be 100 volts times 100 ma., or 10 watts.

The rugged cold-cathode does not require starting auxiliaries, thus making feasible simplified wiring and instant starting. The long life of the electrode has its effect on lamp design, too, but the importance of this feature cannot be completely evaluated until a great deal more is known about the ability of phosphors to maintain their light output over long periods.

To make use of these features of ruggedness and long life, it is necessary to accept the lower current capacity and higher voltage drop of the electrode. Smaller diameter utilizes lower current to best advantage. Long tubes can be used to offset the higher drop of the electrode, as shown in Fig. 2 for one tube diameter and current. Fig. 3 shows the effect of length on the percentage of voltage drop in electrodes for a range of tube diameters operated at a current of 100 ma. The length must be greater for large tube diameters. This is because, with equal current, the volts per foot of arc column decrease as diameter increases. The long length and high

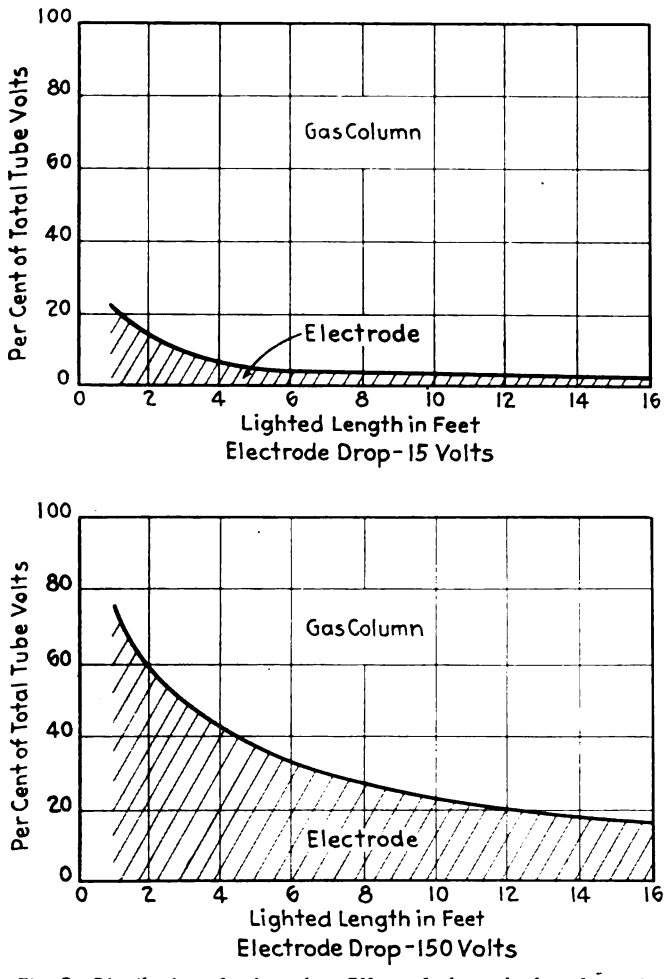


Fig. 2—Distribution of tube volts—Effect of electrode drop for various lengths of G. E. 20-mm. tubing operating at 100 ma.

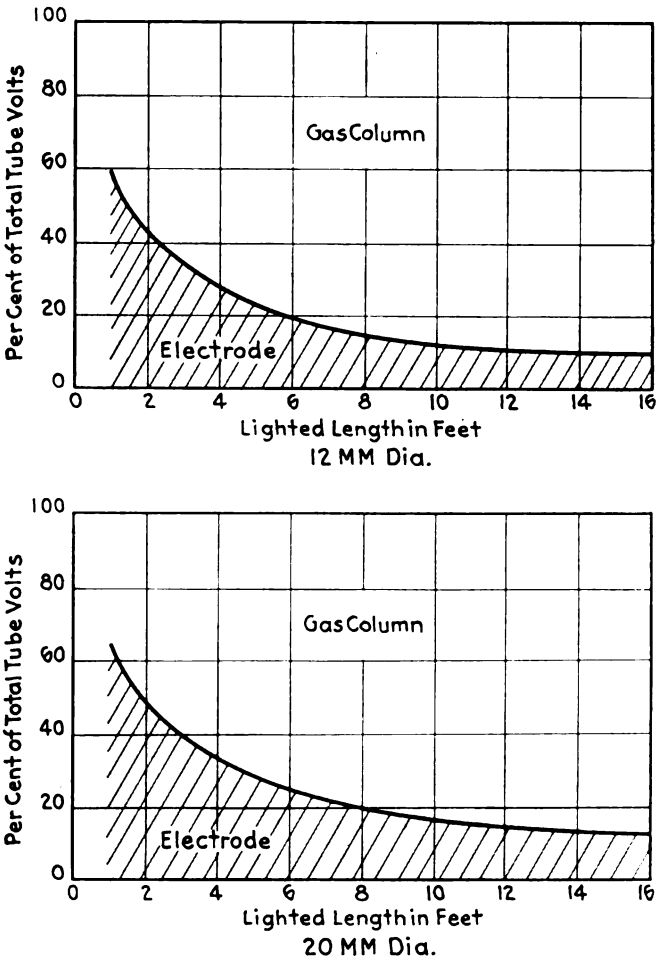


Fig. 3—Distribution of tube volts—Effect of diameter for various lengths of G. E. tubing operating at 100 ma. with an electrode drop of 100 volts

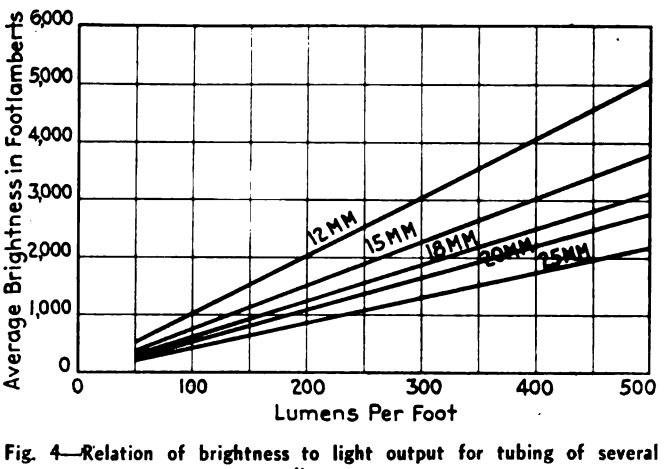


Fig. 4—Relation of brightness to light output for tubing of several diameters

electrode voltage drop makes it necessary to operate cold cathode tubes on higher voltage.

This is about the way it sums up: The properties of hot cathode lead to a lamp that is shorter, larger in diameter, higher in lumens-per-foot output, operates at higher current and on the low potential of 115 or 230-volt circuits. These lamps will start at these voltages, too, if the cathodes are preheated and an inductive "kick" is provided. The commercial cold-cathode tube is longer and slimmer and is operated in series circuits on high-voltage transformers. More feet of tubing will therefore

Table I—Comparison of Light Output, Brightness and Current Density In One Set of Cold-Cathode Tubes of Various Diameters*

Tube diameter, mm.	Brightness in footlamberts	Lumens per ft.	Current density ma. per sq. mm.
9	3,600	240	1.5
15	1,600	215	0.4
20	1,000	175	0.2
25	660	140	0.12

* Values are for one set of tubes all made of same type of glass tubing, phosphor and gas.

Table II—Variables Affecting Properties of Cold-Cathode Lighting

Variable	Choice	
	Large	Small
Tube diameter	Higher efficiency Lower brightness Longer useful life More footage per transformer Greater structural strength; fewer supports	Higher light output per ft. Smaller space requirement More easily bent Less footage for given illumination
	High	Low
Tube current	Higher light output per ft.	Higher efficiency Longer useful life
Current density	Less footage for given illumination value More footage per transformer	Lower brightness
	Long	Short
Length of tube section	Higher efficiency Fewer electrode housings and wiring connections	Easier to handle, pack, ship and store Simpler to install and maintain
	Low	High
Transformer Secondary Voltage	Lower noise level Less rigorous insulating demands Smaller bulk, less obtrusive, if exposed	Higher efficiency More footage per transformer Less wiring

be needed to do a given lighting job; however, starting switches are eliminated and longer life will also help to offset the higher initial cost inherent in the greater footage of tubing.

The brightness of the two sources will not differ for the same current density, but it is a simple matter to operate cold-cathode tubes at low current density to achieve less brightness. The effect of tube diameter on brightness is shown in Fig. 4.

Characteristics of the lamps, which are of first interest to the lighting system designer, are listed in Tables I and II.

Some differences between hot and cold-cathode systems have been those associated with mass-produced and custom-made products, since until recently, the high-voltage source was not produced in standard units. There is now some trend in the direction of standardization of cold-cathode units as well, with advantages for general lighting purposes. At the same time, the flexibility of the tubing will continue to make it particularly suitable to the requirements of a wide field of custom lighting.

CONSULTING DEPARTMENT

Life Insurance for V-Belts

Can you suggest ways and means of improving the performance and increasing the life of endless V-belt drives such as are used for railway passenger car air-conditioning compressors?

Also Give Attention To Drives Not in Service

Close inspection at the end of each trip of a railway passenger car and maintenance performed by an experienced electrician or mechanic will insure long life of V-belts drives on air-conditioning compressors. If the maintainer is incompetent or careless, the V-belts will not last very long.

V-belts have contact surfaces on the side walls and will seat and wedge themselves in the pulley groove without the high tension required by a flat belt. They require more careful pulley alignment than do flat belts as used on car lighting generators.

If multiple V-belt pulleys are misaligned, the belts will scrape down one side of the grooves as they enter the driven pulley and scrape down the other side of the grooves where they enter the driving pulley. This scraping action will greatly reduce belt life. If pulley shafts are not parallel, the belts working on the longest centers will carry more than their share of the load and will have relatively short life.

If V-belts are allowed to get too loose or wear badly, they will climb out of the pulley grooves and get mixed up with the rest of the belts, tearing them off, and causing an air-conditioning failure. Very loose V-belts will squeak badly when the load is applied.

On applying multiple V-belts they should be matched for uniform length. In replacing endless V-belts, complete sets should always be applied. Do not replace one or more belt or belts on a drive by a new one since a new belt is shorter than the old belts left on pulley and may hog the load to the extent of breaking the cotton cords inside, destroying itself as a load-carrying medium. Partly worn V-belts which are removed can be used provided they are matched with others of the same length.

Correct belt tension is important. Both under-tighten-

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church street, New York.

We make a practice of "blocking" our Diesel-electric locomotive generator commutators after each run. This consists of scrubbing them with a canvas-covered block curved to fit the surface of the commutator. It does not remove the glaze but it does clean them; and when treated in this manner they seem to require no other maintenance. Can you suggest any way in which we can similarly retain a good commutating surface on our traction motors?

ing and over-tightening will shorten the life of V-belts. Where pulleys have fixed centers, tension should be closely watched because there is a gradual stretching as the cords give throughout the life of the V-belt.

When V-belts are applied, they should be well seated and equalized on both sides before checking the tension. This can be done by running the compressor about a half hour and then pressing down on one belt at a time with a finger. It should be possible to get about a 1-in. deflection of each belt.

On a Waukesha compressor there is an idler or automatic belt tightener arrangement. When applying new belts, the tighteners are turned as far as possible and proper tension is automatically retained throughout the life of the belts.

When applying new V-belts to any drive, the tension device should be backed off or released so that the V-belts can be applied freely over the pulleys. If the belts are forced over the pulleys a ply break may occur, resulting in damage to the belts.

Endless V-belts should be kept clean and free from oil. Belts not in use should be stored in a cool dark place, but not laid on a damp floor or where they may be subjected to water or steam.

On dining cars, if equipment is cut out for the winter, belts should be removed and pulleys red-leaded and wrapped with canvas. Where diners are in service or subject to all-year-round service, drains should be installed under the car to keep water, garbage, greasy dishwater, soap and salt from coming back on pulleys and V-belts.

Rusting away of pulley grooves may cause V-belts to ride the bottom of the grooves. This should never be allowed. We use a gage or templet to check pulley grooves. It tells the story at once; and if grooves are worn, we change pulleys. This adds to the life of belts. Any excessive belt slap, squeak or noise should be noticed and corrected at once.

V. W. WHITE,
Electrician,
Illinois Central.

Rules for the Inspector and Maintainer

The life span of an endless V-belt varies from one to a few years depending on belt speed, belt tension, sheave diameter, alignment, continuous loading, severity of overloads at starting and during operation and other factors determined by the specific application.

The useful life of a V-belt does not necessarily imply its continued use until it is broken. Experience indicates that in some cases it is advisable to replace V-belts before they break. It seems that either through surface wear or oxidation of the rubber compound, V-belts develop a slip. This slip takes place quietly, without the usual symptoms of slippage or odor of burning rubber. It can only be detected by accurate checking of the relative speeds of driver and driven sheaves. It is difficult to judge when a V-belt needs to be replaced unless it displays a cracked, ragged and generally weak appearance.

Inasmuch as V-belts are much stiffer and heavier for the same speed and power than flat belts, they have a greater tendency to lift out of the sheave grooves. This bulge decreases their arc of sheave embrace, especially at speeds near 4,000 ft. per min. and sheave diameters close to the permissible minimum. Furthermore, the higher the speed, the greater is the inequality of load sharing among the V-belts of a multiple drive.

Increasing V-belt tension to reduce the bulges due to the centrifugal force and to increase sheave embrace and wedging only results in further elongation and shortening of belt life. Increased bearing pressures and overheating of bearings are also associated with excessive belt tensions.

Improper alignment of sheaves is perhaps the most common source of V-belt failure. V-belts have to be aligned more accurately than flat belts but not quite as accurately as silent-chain drives. Lateral misalignment produces wear, and deviation from parallelism of driver and driven shafts results in inequality of load distribution.

Lateral misalignment may be detected by the pulverized rubber and textile material being deposited in the vicinity of the drive. This undue wear is caused by the scraping of the belt on entering a groove and a squeak on leaving the groove. On a compressor drive such as used in railway air-conditioning units, the detection of this dust would depend largely on the design of the unit. Lack of parallelism is usually evidenced by repeated failure of belts working on the longer centers of a multiple drive.

Some belts have a tendency to roll over and operate on their side or climb out of a groove and run on top of an adjacent belt. If better alignment of sheaves fails to correct this condition, shorter belts working on shorter centers usually will.

V-belts stretch to various extents, comparatively more during the first few hours or days of service than later. This initial stretching allows the belts of a multiple drive to adjust their lengths and equalize their tensions so as to carry a proper portion of the load. If belt tension is moderate and loading within the prescribed limits, the textile materials are well preserved and belt life is extended.

In a multiple V-belt drive when one of the belts breaks, a replacement of the whole set becomes necessary. A new belt of the same nominal length is usually shorter than the broken belt and if used with a set of old but serviceable belts, it would hog most of the load and destroy itself in a relatively short time. The replaced serviceable belts can often be used successfully on other similar drives with used belts when belt replacement becomes necessary.

In improving the performance and extending the life of V-belts, the following factors should be considered:

1—V-belt speed is not to exceed 3,500 ft. per min. unless the sheave diameters are well above the recommended minimum for the belt size. It is not advisable to exceed a belt speed of 4,000 ft. per min.

2—V-belt tension should be such as to cause very little elongation after the usual initial stretch.

3—Sheave sizes smaller than the recommended minimum should never be used.

4—V-drives should be periodically checked against lateral misalignment, loss of parallelism, rolling over, climbing and squeaks.

5—V-belts should not be overloaded. The number of belts in parallel should be increased, if necessary.

6—V-belts should be kept away from oil sprays and drippings.

7—In replacing individual belts on multiple drives, a new belt should never be used with old ones on the same sheave.

R. G. CAZANJIAN,
Electrical Engineer,
Brooklyn, N. Y.

Long Life for Evaporators and Condensers

What can I do to get the best service and longest life from the evaporator and condensers in our air-conditioned cars?

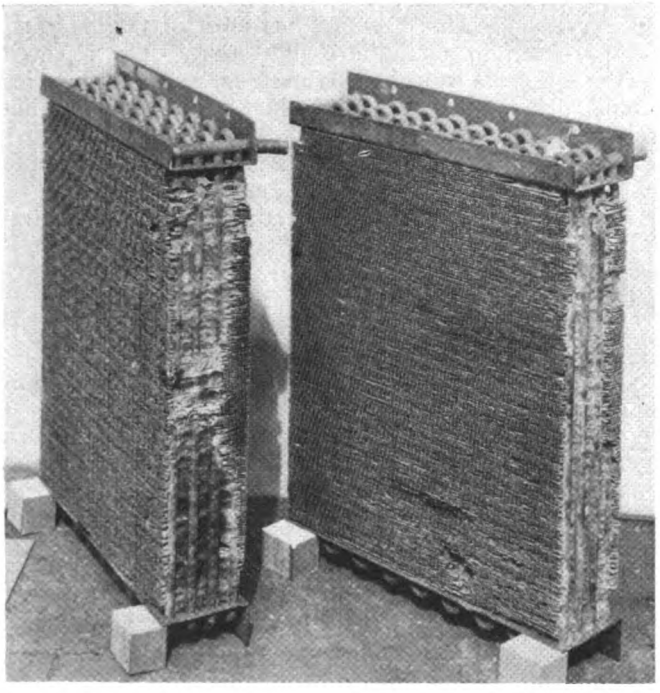
Delay in Cleaning May Ruin Condenser Elements

The article by V. W. White on "Long Life for Evaporators and Condensers" which appeared in the April issue of *Railway Mechanical Engineer* (page 189) is an important contribution, and more information of this kind should be published so that present air-conditioning equipment may function at its maximum efficiency.

I can appreciate that most railroads have a strict schedule covering the maintenance of their equipment. However, I am afraid that possibly during this present emergency, when the railroads are pushed to the limit in handling increased passenger travel as well as freight, that their present air-conditioning equipment may become somewhat neglected. This, of course, would mean increased cost in major repairs as well as increased power consumption. This could be avoided if regular and thorough maintenance programs are adhered to.

The accompanying photograph of a Freon condenser coil shows one which we recently received from a railroad. We were required to clean, repair and test two of these coils so that they could be replaced in service. The photograph was taken after our shop had completed the work of "attempting" to place the coil in first-class condition.

The casual observer may say that the workmanship on these coils leaves much to be desired. However, had he seen the condition in which they were received for repairs, he would admire the effort made to return the units in serviceable condition so that they might at least function satisfactorily for the duration of the war.



These air-conditioning condenser sections were allowed to remain in service so long without proper cleaning that a first-class repair job was impossible

The fins in the coil face of the condenser were battered in service by flying ballast, and they have been hand-straightened as much as possible. The exposed tubes were originally covered by fins, but due to dirt, dust, grease and the elements, a large portion of the fins have eroded, thus causing the loss of condenser capacity. The badly eroded section happens to be the top of the coils as they are arranged under the car.

For at least a depth of 1½ in. down from the top, a combination of dirt and stones are jammed between the fins to form a substance comparable to hardened cement, resulting in further loss of condensing surface. It was impossible to remove this "cement."

Frequent cleansing of these coils while in service, as explained in Mr. White's article, would have prevented this.

H. Hemming
Railroad Air-Conditioning Dept.
B. F. Sturtevant Company

One Eye Blind

(*Continued from page 283*)

heavier wire or more careful handling of the turntable controller."

"But it doesn't tell why the electric eye at Middleton goes blind," Johnson remarked dryly.

"I'M GOING to have them wire for a factory expert and tell him to bring a new panel," Sparks told him.

A few days later Sparks was again working on the fuel oil cranes at Plainville when the roundhouse foreman told him that the expert from the factory would be in Middleton next day and the electrician was to meet him there.

A new panel didn't affect the performance of the electric eye perceptibly. "Acts like it had a condensor in the line," the factory man said.

"Maybe that heavily insulated ignition wire in the conduit is acting as a condensor," Sparks said.

"Hell, yes!" the factory man exclaimed. "That's it! Wonder if there's a radio shop in the town?"

"There's one about seven or eight blocks from the depot," Sparks told him.

The factory representative purchased a quantity of "spaghetti" tubing at the radio shop, then went to a dry goods store where he bought a box of ordinary composition buttons, then he and Sparks went back to the boiler room.

Sparks, wondering but saying nothing, watched while the factory man went to his grip and picked up a spool of bare number 22 copper wire. "Here, you can help. You see the tubing is in seven-inch pieces. Slip a piece of tubing on each wire, then run both wires through opposite holes in a button, then two more pieces of tubing, and so on. The buttons will keep the wires away from the conduit," he explained.

When the tubing and buttons were on the wires they were pulled carefully into the conduit. The wires were connected and the switch closed. It worked nicely.

"Now I can understand why it worked when the water service men did the wiring and wouldn't work after we ran the wires in conduit," Sparks said, as he gathered up his tools.

Locating Work Center By Optical Instrument

The precision demanded in machine operations has resulted in the development of many shop tools to achieve such results. But often the ultimate in precision on some types of work is not reached because of an error in setting up the work. Beyond certain limits it is not possible to eliminate errors, such as, for example, in locating centers, when that operation is performed by unaided visual means. To provide such assistance the Center Scope was developed by the Center Scope Division of Kearney and Trecker Corporation, Milwaukee, Wis. The Center Scope is an optical locating tool which makes it possible for the operator to locate scribed work lines on the piece to be machined so that their intersection will coincide with the centerline of the machine spindle or, if there is run out in the spindle, to compensate for such error to an accuracy of .0001 in.

The Center Scope is of two general types, the variable and the rotating. The variable type is used on vertical and horizontal machine tools where the locating is done with the spindle stopped. The rotating type has a revolving shank and is designed primarily for locating work on horizontal boring and drilling machines where the operator holds the eyepiece and centers a lay-out while the machine spindle is running. Both types have a magnification of 45X and both have guide lines spaced .0015 in. to .002 in. apart. The variable type instrument has one set of guide lines and the rotating type has two sets at right angles.

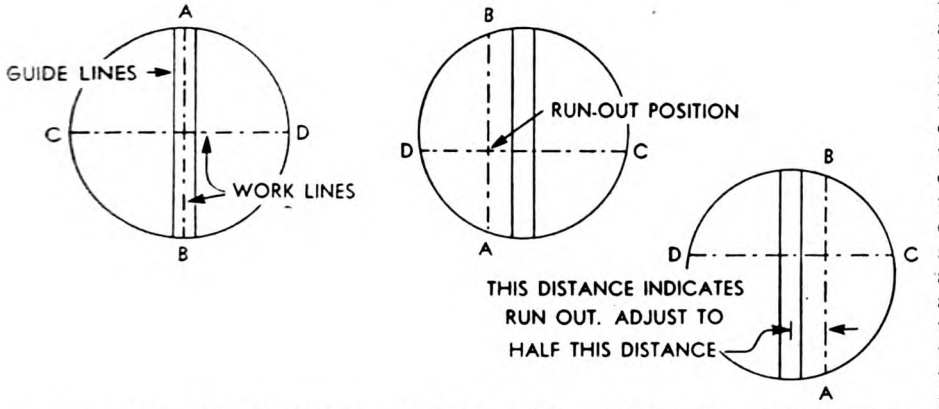


Fig. 1—(Left) Method of centering one of the work lines between the guide lines before rotating the spindle 180 deg., the result of which is shown in Fig. 2—(Right) in the case of a spindle having run-out

In using the variable Center Scope it is placed in the machine spindle and brought into focus by moving into such position that the nose of the instrument is approximately ¾ in. from the work. The work is then adjusted until one work line *AB* (Fig. 1) is centered between the guide lines. The spindle is then rotated 180 deg. until guide lines are parallel to the work lines and the eyepiece is pointing in the opposite direction. If the work line *BA* again appears centered between the guide lines no further adjustment of the work is necessary except to center the cross line *CD* to the spindle axis by rotating the spindle 90 deg. and proceeding in a similar manner. The above method of use assumes an absolutely true running spindle. Where run-out of the spindle exists a condition similar to that shown in Fig. 2 will be seen after rotating the spindle 180 deg. subsequent to centering the work line *AB* between the guide lines. The variable Center Scope has a trimming screw by turning which the guide lines may be shifted. In the case shown in Fig. 2 the guide lines are now adjusted to one-half the run out distance and the work is reset to correct for the other half, thereby bringing work line *BA* into a central position between the guide lines. The spindle is then rotated 180 deg. These operations are repeated until *AB* and *BA* remain centered between the guide lines from each of the 180-deg. positions of the spindle. This will split the spindle axis within .0001 in. It is now only necessary to center the other cross line *CD*, the method for which has already been explained.

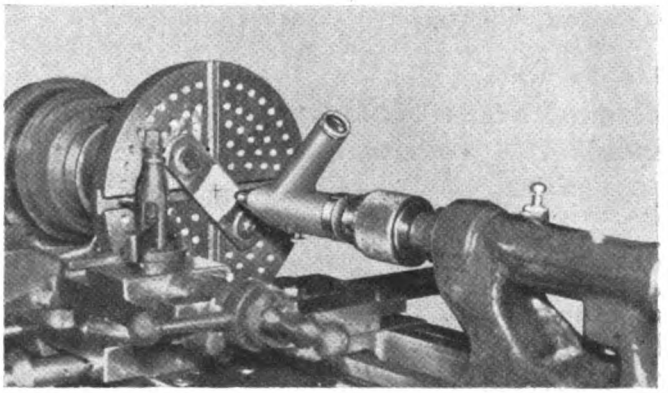


Fig. 4—A variable type Center Scope used to locate the centers on work mounted on the faceplate of an engine lathe

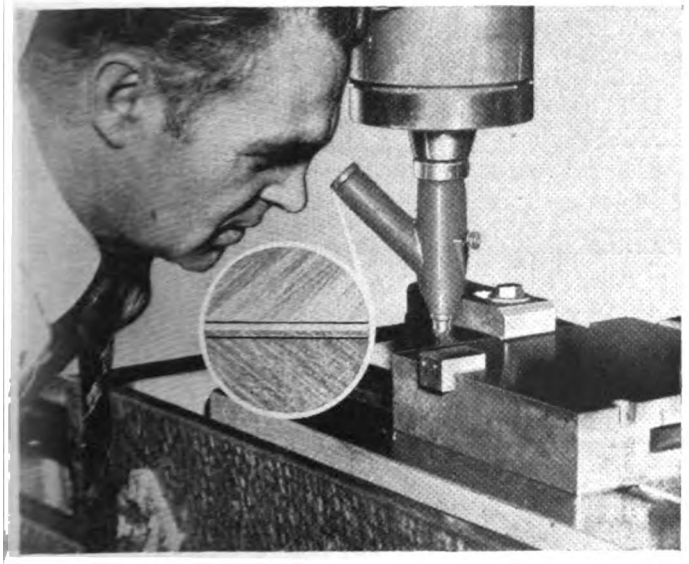


Fig. 3—In this case the Center Scope is being used in the spindle of a vertical mill to line up the work by the use of edge blocks

Fig. 3 shows the variable Center Scope being used with an edge block to line up the edge of the work with the spindle axis. On vertical mills this is often done to establish starting points from two edges so that measuring rods or lead screws may be used to control the distance from the edge to

any hole. This method eliminates the need for any concern over possible inaccuracies due to lead screws, back lash or table inaccuracies. Fig. 4 shows the variable type instrument being used in a lathe to locate a piece of work on the face plate.

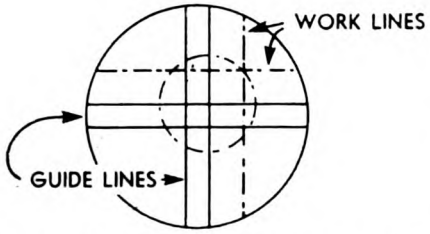
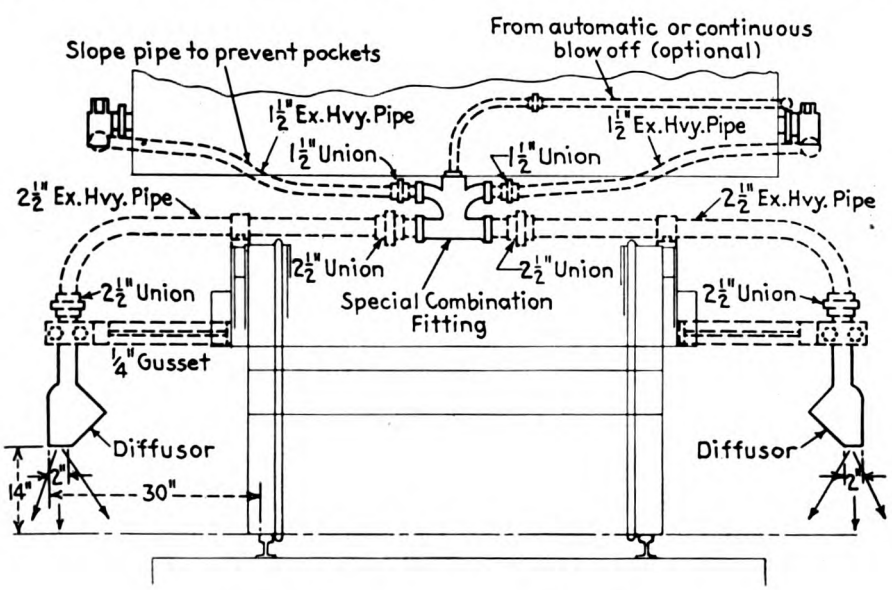


Fig. 5—The rotating type of instrument can be used to determine the spindle run-out by holding the eyepiece and causing the work lines to appear to travel in a circle

The rotating Center Scope, with the ball-bearing, revolving shank, permits the operator to hold the eye-piece with one hand so that one set of guide lines parallels one of the work lines. The spindle is run at low speed, or turned by hand, and run-out, if any exists, will cause the image of the work lines to appear to travel in a circle. In such case the table or the spindle is adjusted until the work lines travel concentric to the square formed by the guide lines. This is illustrated by Fig. 5. Special adapters and accessories extend the usefulness of the Center Scope to a variety of jobs.

Locomotive Boiler Blow-Off Arrangement

In the May issue of the *Railway Mechanical Engineer* on page 239 appeared an article under the above title describing the Locomotive Blow-off Diffusor Set developed by the Wilson Engineering Corporation, Chicago. The drawing showing the method of piping the diffusor set which accompanied the article was incorrectly dimensioned in a number of places. The illustration, correctly dimensioned, is repeated herewith.

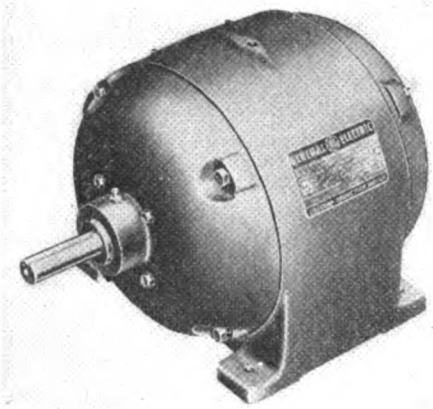


Method of piping the Locomotive Blow-Off Diffusor Set

Totally Enclosed Motors

A line of totally enclosed Tri-Clad motors has been announced by the Motor Division of the General Electric Company, Schenectady, N. Y. Available in both the polyphase, 60-cycle induction type and the single-phase, 60-cycle capacitor type, the new motors are especially designed for use under conditions where abrasives, chemicals, rain, snow and excessive dirt are encountered.

The polyphase motors are furnished in frame sizes 203 to 225. They include ½, ¾, and 1 hp. at 900 r.p.m.; ¾, 1, and 1½ hp. at 1,200 r.p.m.; 1, 1½, and 2 hp. at 1,800 r.p.m.; and 1½ and 2 hp. at 3,600 r.p.m. The single-phase motors are furnished in frame sizes 203 and 204, and include ¾ hp. at 1,200 r.p.m.; 1 and 1½ hp. at 1,800 r.p.m.; and 1½ and 2 hp. at 3,600 r.p.m. The mounting dimensions of these motors are interchangeable with Tri-Clad open motors of the same rating.



Polyphase totally enclosed K225 induction motor

These motors have all the important basic features of the Tri-Clad group, the most recent addition to General Electric motors. This includes triple protection—protection against physical damage, electrical breakdown, and normal operating wear and tear.

In addiiton, all parts of the motor enclosures—frame and shields, and conduit boxes—are cast iron, thus offering resistance to rust, corrosion, accidental blows, and rough use. The leads are permanently encased in compound in a cast-in pocket in the stator frame, thus preventing liquids from seeping into the motor. Still further protection is provided in the form of a rotating labyrinth seal. The motors are wound with Formex wire.

Asbestos Cement Conduit

An asbestos cement conduit, intended principally for cable installation, is now produced by The Philip Carey Mfg. Company, Cincinnati, Ohio. A feature of the conduit is the Flexcaulk coupling which consists of a tubular housing of asbestos cement to which is bonded a tapered liner of mineralized asphalt compound. The liner permits a flexible, self-aligning, water-tight joint when properly assembled with a special sealing compound.



The joints will remain water-tight even under ground-settling action

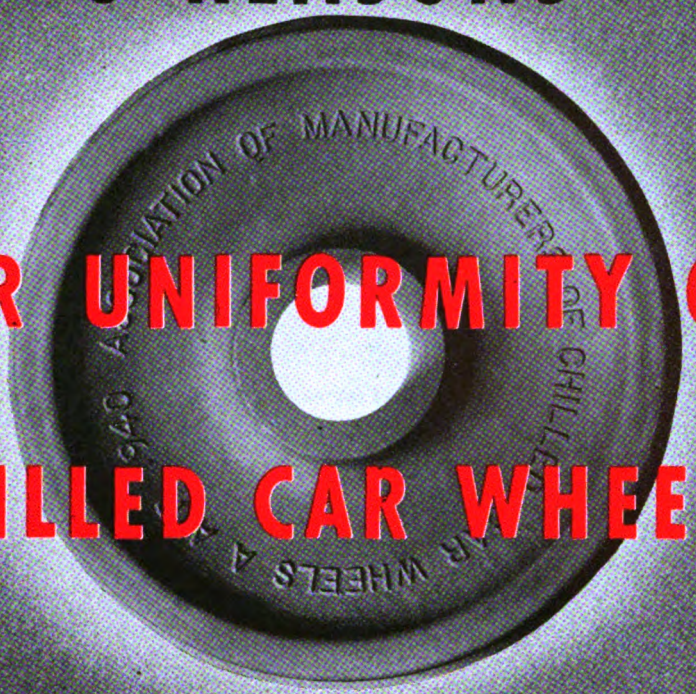
The conduit is made in two thicknesses for installation with or without concrete encasement. It may be cut to length on the job and only unskilled labor and simple tools are required for its installation.

Universal Vise

A vise which swings through 180 deg. in the top plane, 90 deg. in the vertical plane, and 360 deg. in the bottom plane is said to reduce setting-up and tooling-up times to a considerable degree. Manufactured by the

(Continued on next left-hand page)

6 REASONS FOR UNIFORMITY OF CHILLED CAR WHEELS



ASSOCIATION INSPECTION ENFORCES THESE TESTS:

1. **Chill Test Block taken at least once in every ten wheels poured.**
2. **One complete Chemical Analysis Block with each heat.**
3. **Constant Pyrometer checks for accurate process temperature.**
4. **Drop Test of finished wheel (AAR specifications).**
5. **Thermal Test of finished wheel (AAR specifications).**
6. **Test for perfect rotundity.**

Every Chilled Car Wheel is given these six rigid tests, thus assuring absolute uniformity.

Under our unique wheel exchange plan, by which you receive new wheels for old on a conversion charge basis, scrapped chilled wheels are speedily melted and recast into new wheels. Thus re-employment of scrap metals is of great help in the war effort.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

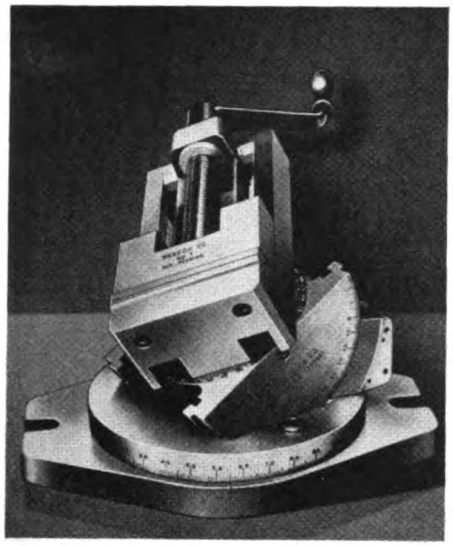
230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

3289

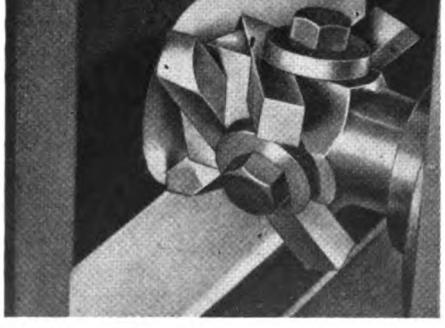


Adjustable vise which gives a wide range of possibilities in positioning work pieces

Wesson Company, Detroit, Mich., the vise is available in two sizes. They are completely graduated in all planes and, where extreme precision is required, can be obtained with vernier graduations. The smaller model has a jaw opening of 1⅜ in. and a height of 4⅜ in.; the larger has a jaw opening of 4 in. and a height of 6⅛ in. Both may be equipped with angle plates to accommodate large or irregularly shaped pieces.

Adjustable Surface Grinder

An adjustable tool for efficient surface facing in horizontal or vertical milling machines, lathes, and other spindle machines



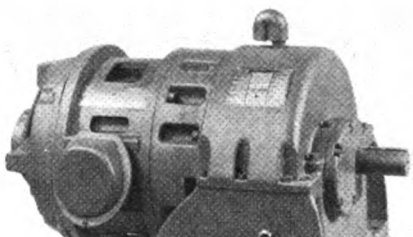
Surface facing can be performed in a number of different type machines using this tool

has been developed by the Robert H. Clark Company, 3424 Sunset boulevard, Los Angeles, Calif. It consists of a tapered shank and body with three adjustable high-speed bits, which may be set for any diameter within the range of the tool. Straight shanks are also obtainable. With only four tools any diameter from 1¼ in. to 5 in., inclusive, may be obtained without being limited to standard fractional dimensions. A measuring gauge is provided with each tool for quick and accurate size adjustments. The bits can be easily reground or can be replaced at comparatively small cost, thus lengthening the life of the tool indefinitely.

The tool is useful for dressing castings of any metal, dove-tailing, spot facing, as an emergency repair tool, and for other end-mill, facing-mill, or slab-mill operations.

Gearmotors

A line of horizontal parallel-shaft type gearmotors which meet speed-reduction requirements for a wide variety of applications over a range of 1 to 75 hp. is announced by Westinghouse Electric and



Type C double-reduction gearmotor

Manufacturing Company, East Pittsburgh, Pa. Each new unit conforms to A.G.M.A. standard output speeds and application practices.

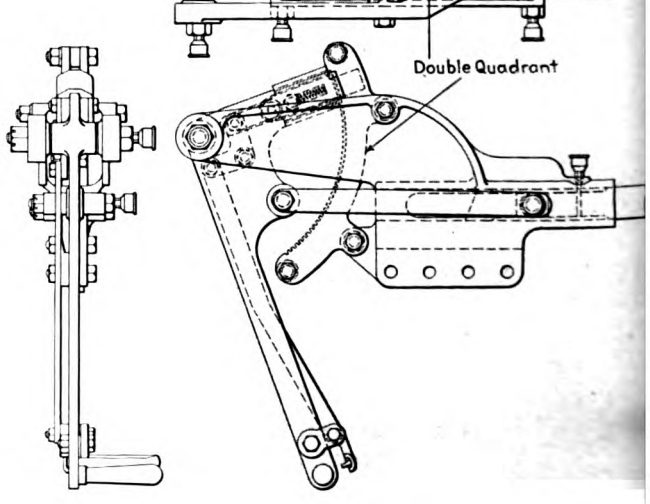
The use of adaptor castings between motor and mechanical parts allows the use of all standard Westinghouse N.E.M.A. frame motors with each type of unit, and types of motor construction can therefore be readily changed to suit varying service conditions if necessary in the field. The design of the motor-adaptor assembly being common between unit types, such assembly can be readily shifted between unit types to meet changes in speed requirements. Many working parts, including gear sets, being common to all three unit types of a given rating, replacement part programs are held to a minimum.

Gears and pinions in the new gearmotors are of .40-.50 carbon steel, and are given special heat treatment before hobbing. This process produces a tapering hardness from surface to core, and results in tough, impact-resisting teeth. Gears and bearings are lubricated by a positive splash system, and new case design allows oil to circulate freely at all times.

The new gearmotors also feature compactness and improved foundation stability through heavy exterior ribbing of the housing at each mounting hole.

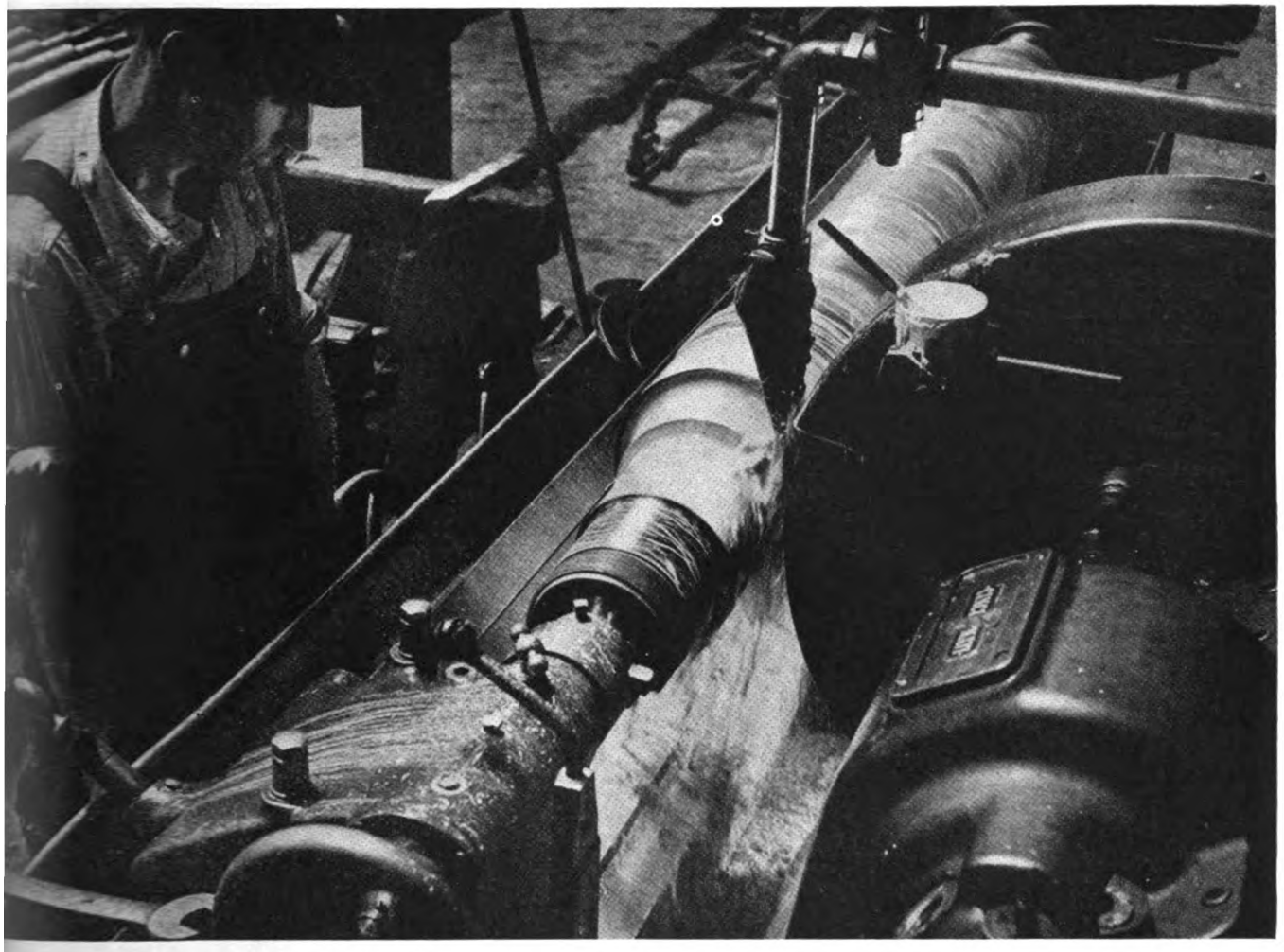
Throttle Lever With Double Quadrant

A double-quadrant throttle lever assembly for application on any steam locomotive where the connection to the throttle is outside the boiler has been developed by the American Throttle Company, New York. The assembly consists of a double quadrant mounted on the assembly bracket, a throttle lever in bell-crank form on the ends of the short arm of which the latches are mounted, and a crosshead guide for the rear end of the throttle operating rod. A special feature of the double quadrant is the staggered position of the teeth of the two quadrants. This permits a fine throttle adjustment with relatively large quadrant teeth. The quadrants are in a vertical position in front of the lever so that there are no parts projecting beyond the lever itself



Double - quadrant throttle lever with the quadrant in front of lever

(Turn to next left-hand page)



On modern grinders Lima brings to a perfect finish the axles and shafts whose proper fit plays an important part in low maintenance.

"AVAILABILITY" IS AT A PREMIUM!

Squeezing extra miles per month out of every locomotive is a major operating problem today.

Lima's reputation for soundly built locomotives has a firm foundation in the many special Lima methods and equipment that make for low maintenance.

This policy is now of exceptional value to Lima customers. It is helping them meet the problem of keeping locomotives in service.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

High Spots in
Railway Affairs . . .

Railroad Officer Is Honored for Bravery

Lieut. Col. Frederick W. Okie, Transportation Corps, Army Service Forces, was awarded the Legion of Merit by General Eisenhower for valorous action under fire in the North African theatre of operations. The citation read: "For exceptionally meritorious conduct in the performance of outstanding services during the period February 16 to 18, 1943. Lieutenant Colonel Okie organized and led a detachment of his battalion beyond our own lines to the vicinity of Moulares, Tunisia, to attempt to bring out two trains of ammunition which had been abandoned after a rapid enemy advance. When enemy forces closed in and made movement of the trains into our lines impossible, he supervised the destruction of the locomotives, assembled his detachment and a number of civilian refugees, and led them all to safety by a circuitous route through the desert to Tebessa." Colonel Okie was born in Dayton, Ohio, June 7, 1907, and is a graduate of the Virginia Military Institute. He worked for many years in the operating department of the Southern Railway and was superintendent at Birmingham, Ala., when called to active duty.

Eastman on WPB

During the first World War Director General of Railroads William G. McAdoo, who was Secretary of the Treasury and a member of President Wilson's War Cabinet, was in a strategic position to see that the railroads got badly needed materials and equipment. Until recently, in the present World War, transportation was quite on the outside when it came to dealing with the War Production Board, which has "general direction over the war procurement and production program." To insure maximum production of war munitions this board "directs the orderly mobilization and use of the economic resources of the Nation." The railroads are the backbone of the transportation system—a vital factor in the production program. They have made a truly marvelous record thus far and the administration seems to view them as having almost inexhaustible possibilities. Those who are familiar with railroad operation, however, realize that they have been stretched almost beyond the elastic limit and that they must receive greater consideration from the standpoint of additional equipment and materials. It is of more than passing interest, therefore, that President Roosevelt recently appointed Joseph B. Eastman, director of ODT, as one of three additional members on the War Production Board. The two other new appointees were Paul V. McNutt, chairman of the War Manpower Commission, and Petroleum Administrator for War Harold L. Ickes.

Treat Railroads Fairly!

Among the resolutions adopted at the recent annual meeting of the Chamber of Commerce of the United States was the following: "The railroads are among the largest employers and taxpayers of the country and the heaviest buyers of a great variety of supplies and equipment. Improvement in the situation of the railroads in the post-war period will bring many public benefits. They have during the war period shown their essentiality and their capacity to perform a great public service. Steps should be taken promptly by Congress to insure development of a long-term program for placing essential railroad transportation on a stable basis. On the other hand, proposals for federal and state legislation which would further interfere with the proper functions of management or impose additional financial burdens should be resisted. Examples relate to length of trains, full crews, and a six-hour day. The federal government itself should give up the preference it enjoys because of grants of public land to aid original railroad construction. The government has long since realized in this reduction of rates more than the value of the grants."

Absenteeism

The Administration continues to be deeply concerned over the great loss in war production due to unnecessary absenteeism. Readers of the *Railway Mechanical Engineer* will recall the pertinent and practical suggestions which were advanced in the Roundtable discussion in our April issue. Two government pamphlets have been received during recent weeks that are well worth study. One of these, which may be obtained from the Division of Labor Standards, United States Department of Labor, Washington, D.C., is entitled, Controlling Absenteeism. Its 60 pages include a great number of suggestions, based on the experiences of about 200 war plants. Another smaller pamphlet is one of a series of manuals published by the War Production Board for the guidance of plant labor-management production committees. It is entitled, Ways of Dealing With Absenteeism, and is intended for the guidance of a sub-committee on absenteeism. It not only deals with methods used in combating the in-plant causes of absenteeism, but also suggests methods for developing community co-operation in handling other situations which contribute to absenteeism.

Railroads Need New Equipment

Col. J. Monroe Johnson, I. C. C. member, in a roundtable discussion over the network of the NBC, made this challenging statement: "Although the railroads have performed and are performing miracles with the equipment they have, they are fast approaching their physical limitations. They must have additional equipment, particularly locomotives, if they are to continue to supply fully the want of this transportation-consuming nation. I can think of no more advantageous allocation of steel than one that will insure the arrival on the battlefront of armament, food and clothes. In fact, it takes railroads to deliver the materials that go into the manufacture of the engines of war in the first place. If our railroads fail, our entire world-wide military effort fails. We might suffer military reverses, and still win this war. But we can't avoid defeat should our railroads fail."

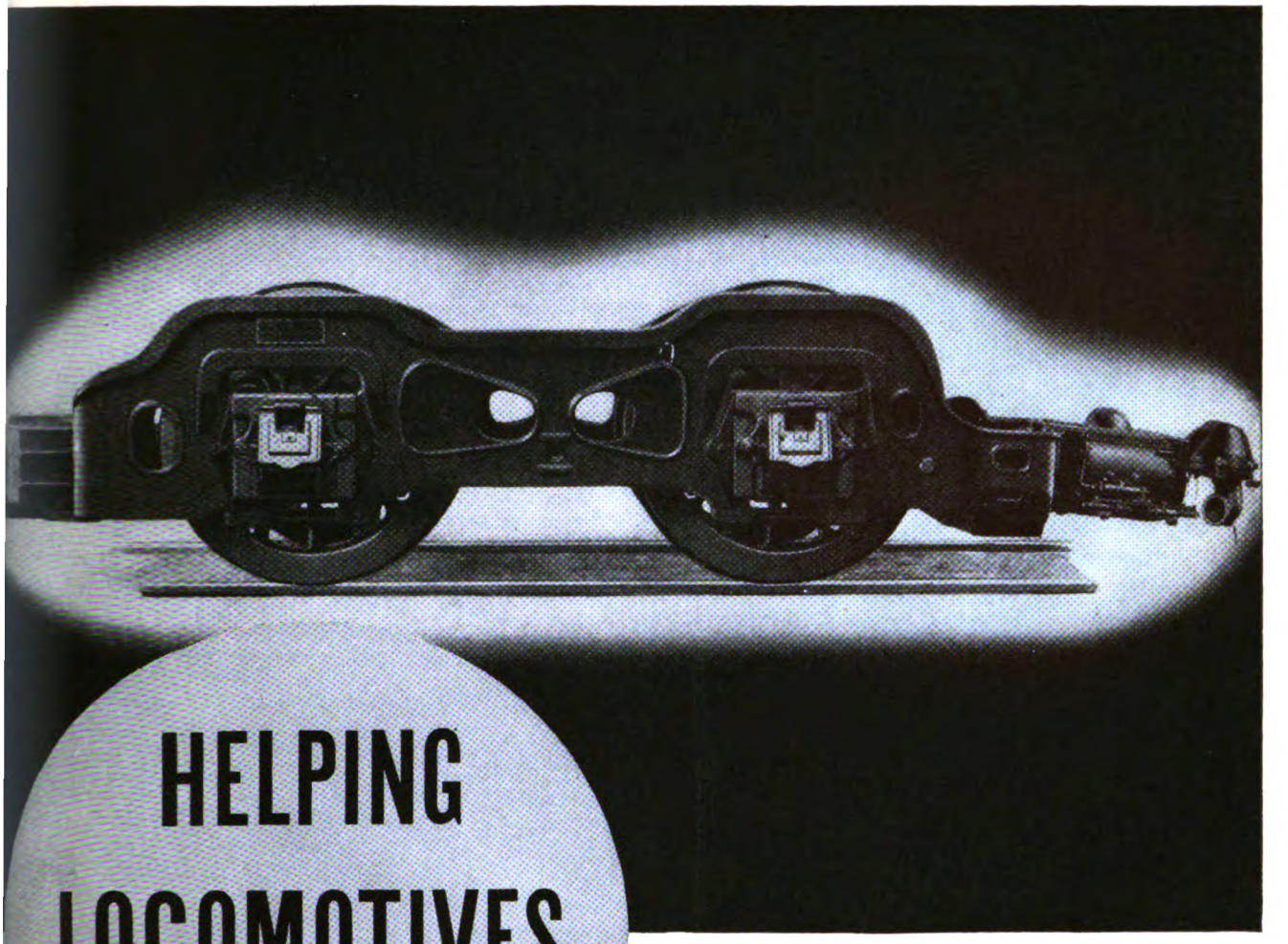
Heavy War Traffic

According to Major General Charles P. Gross, chief of the Army Transportation Corps, a troop movement by rail is being started somewhere in the United States about every six minutes, day and night. The railroads are carrying in organized parties approximately two million members of the military forces a month. During the first year of America's participation in this war we shipped to our troops overseas twice as much material and supplies per man per day as we did in the corresponding period in the first World War, and there were very nearly three times as many of our men overseas as there were at the same time in the last war.

Railroads Need New Rail

Ralph Budd, president of the Chicago, Burlington & Quincy, pointed out at the annual stockholders meeting of that system that the railroads are operating close to their maximum capacity and must have new rails, more motive power and additional cars. "You can make cars last a little longer and you can make locomotives run a little longer," said Mr. Budd, "but when a rail fails there is nothing to do but put in a new rail. The extremely severe use of the railway plant has caused rails to become, perhaps, the most critical of all of our material problems, and if the war lasts long it will be imperative for new rail to be laid to carry on safely with the constantly growing burden of traffic."

(*Turn to next left-hand page*)



HELPING LOCOMOTIVES MOVE *more tons..more miles..faster*

he tremendous increase in traffic . . . 630 illion ton-miles of freight traffic alone in 942 . . . has placed exceptional demands pon the railroads.

Booster-equipped locomotives have layed an important part in keeping war naterial rolling. While the Booster* supplies the required additional power for starting heavier loads, it is more than simply a starter. Its principal contribution to railroad economics is the speeding up of train movement all along the line by supplying a supplementary power to meet the operating emergencies of the road.

*Trade Mark Registered U. S. Patent Office

FRANKLIN RAILWAY SUPPLY COMPANY, INC. NEW YORK CHICAGO

In Canada: **FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL**

NEWS

Eastman Appointed to WPB

TRANSPORTATION finally got a seat at the War Production Board's head table late in April when President Roosevelt appointed Joseph B. Eastman, director of the Office of Defense Transportation, as one of three additional members to the Board. The other two new appointees are Paul V. McNutt, chairman of the War Manpower Commission, and Petroleum Administrator for War Harold L. Ickes.

WPB Allocations and the Equipment Situation

JOSEPH B. EASTMAN, director of the Office of Defense Transportation, in a statement issued on May 14, declared that unless the War Production Board Requirements Committee finds it possible to allocate more material for the third quarter for transportation, new freight-car production will have to be suspended after present schedules are completed, thus making the equipment situation even tighter in coming months than it has been in the past. This statement was based on the May 2 announcement of WPB which revealed that the Requirements Committee had found it necessary "to make an overall reduction of more than 23 per cent in the requests of the claimant agents" for critical materials. The WPB announcement also stated that as to carbon steel, claimant agencies other than the Army, Navy, Aircraft Resources Control, and the Maritime Commission were cut "about 27 per cent" below requests.

Total requests from claimant agencies, according to WPB, amounted to more than 20,000,000 tons of carbon steel, while the estimated supply in the third quarter is slightly under 15,000,000 tons.

"The rail situation is being watched closely by ODT," Mr. Eastman said. "Should the amount of steel for this purpose prove inadequate to maintain the roads at reasonable operating standards further steps will have to be taken. Obviously, rail cannot be allowed to deteriorate beyond a certain point before being replaced. I shall pursue this matter, and also the construction of additional freight cars, with the War Production Board. . . . Unless material can be found at least for replacements, I fear that serious consequences may result."

Sufficient material has been allocated to maintain locomotive production at full plant capacity, Mr. Eastman pointed out. On the basis of present production, domestic roads during the third quarter will get approximately 258 freight locomotives, and during the fourth quarter 307. The locomotives for the third quarter include 145 steam, 27 5,400-hp. Diesel-electrics, 85 Diesel switchers, and 1 electric locomotive.

On the basis of present estimates, total deliveries of new locomotives and freight cars for the year 1943, including those already made, will be as follows: locomotives, over 900; freight cars, 26,000 (including approximately 6,000 of which were authorized but not built during 1942).

Repair Stocks Allowed by WPB

PROVISIONS of the War Production Board's Controlled Materials Plan Regulation 2 restricting deliveries of certain materials will not apply to materials required to maintain adequate stocks for emergency repairs by transportation systems provided the WPB Transportation Equipment Division has authorized the acquisition of such materials under P-142, the WPB has provided through its Inventory Direction No. 7, effective May 13.

Locomotive Specialty Industry Advisory Committee

A LOCOMOTIVE Specialty Industry Advisory Committee was recently created by the War Production Board with Andrew Stevenson of the WPB as presiding officer and with the following membership: J. A. Amos of the Pyle-National Company, Chicago; Bard Browne, Superheater Company, New York City; George H. Carr, Locomotive Firebox Company, Chicago; S. G. Down, Westinghouse Air Brake Company, Wilmerding, Pa.; C. G. Learned, Okadee Company, Chicago; J. E. Long, Franklin Railway Supply Company, New York; Hunter Michaels, American Locomotive Company, New York; Alfred Nathan, Nathan Manufacturing Company, New York; George A. Price, American Arch Company, New York; C. J. Surdy, Standard Stoker Company, Erie, Pa.; C. P. Whitehead, General Steel Castings, Eddystone, Pa.

The members of the committee met in Washington on April 14, at which time the question of the ability of the supply industry to meet the demand for locomotive equipment during the last half of 1943 and 1944 was discussed. Subsequent meetings will be held from time to time as called by Mr. Stevenson.

Pullman Announces Post-War Equipment Plans

THE favorable public reception accorded the Duplex-Roomette sleeping car, which the Pullman Company has operated in experimental service during the last year, has led Pullman Incorporated to make detailed plans for quantity production of this type of car after the war, David A. Crawford, president, announced at a meeting in Wilmington, Del., on April 21.

Mr. Crawford predicted that there will be a large post-war demand for new railway equipment and revealed that both the Pullman Company and Pullman-Standard Car Manufacturing Company, subsidiaries of Pullman Incorporated, are engaged in research designed to secure reduction in manufacturing costs and lowering of maintenance expense of railway equipment of all types. Engineering studies, he added, are constantly underway also in connection with new materials now being developed particularly the alloys of steel, aluminum and magnesium. Special attention is also being given to refining and improving every detail of the cars designed, and these improvements will be incorporated in post-war units.

The Duplex-Roomette car, as the sleeping car in experimental operation since April, 1942, is known, was made before war necessitated a switch of equipment, materials and manufacture to arms production.

Cement Carriers Converted for Oil Transportation

IN AN article on freight-car conversions on page 241 of the May *Railway Mechanical Engineer*, the statement was made that

(*Continued on next left-hand page*)



L.C.L. Corporation Air-Activated containers which have been converted from cement to petroleum carriers

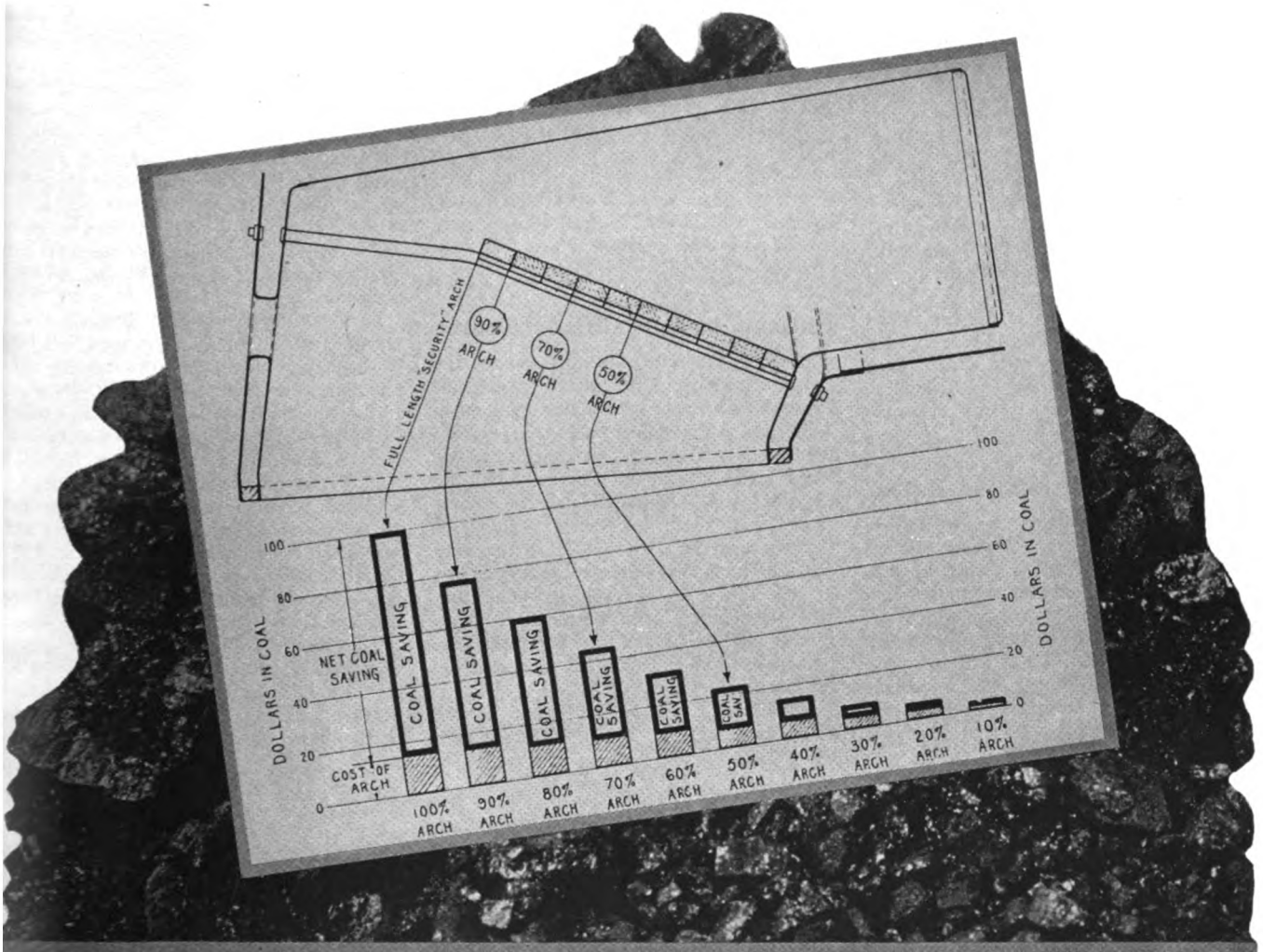
KEEP FUEL-BURNING EFFICIENCY AT A MAXIMUM

Every railroad man is conscious of the wartime importance of each pound of coal.

To make it yield its utmost in steam production is imperative. This is one of the functions of the Security Sectional Arch.

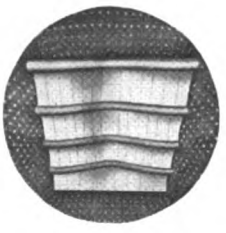
But only a complete arch can achieve the maximum in results. Hence the importance of having full length arches in all locomotives.

This is one sure way of stepping up fuel-burning efficiency.



HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists



AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

Orders and Inquiries for Equipment Placed Since the Closing of the April Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Pere Marquette	12	2-8-4	Lima Loco. Wks.

LOCOMOTIVE INQUIRIES

Road	No. of Locos.	Type of Loco.	Builder
Chesapeake & Ohio	10	2-6-6-6	

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Denver & Rio Grande Western	200[1]	50-ton flat	Mt. Vernon Car Co.
Norfolk & Western	500	50-ton hopper	Bethlehem Steel Co.
	500	50-ton hopper	Virginia Bridge & Iron Co.

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
Ann Arbor	50	50-ton hopper	

PASSENGER-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Defense Plant Corp.	1,200	special type troop sleeping cars	Pullman-Std. Car Mfg. Co.

[1] Pending WPB approval.

100 steel gondolas formerly used as cement carriers were being fitted with steel tanks for transporting petroleum. This is not correct. These L. C. L. Corporation cars were equipped with Air-Activated containers, as shown in the illustration.

The conversion of these containers required only the changing of rubber gaskets to fibre gaskets, primarily because of the necessity of conserving the rubber gaskets for later use when reconverting the cars for cement handling; also, the plugging up of inlet valves and the proper stopping up of outlets, etc.

Each of the five tanks in the car shown in the illustration will hold 1,750 gal., or a total of 8,750 gal. per car. Other cars, fitted with six containers, each holding 1,695 gal., have a total capacity of 10,170 gal.

C. & S. E. Depreciation Rates

EQUIPMENT depreciation rates prescribed recently by the Interstate Commerce Commission for the Colorado & South Eastern were inadvertently omitted from the item reporting issuance of the order which appeared in the May *Railway Mechanical Engineer*, page 242. The order prescribed rates of 2.27 per cent for steam locomotives and 3.85 per cent for freight-train cars.

Tons Per Car Averaged 40.1 in 1942

RAILROADS of the United States in 1942 attained a new high record in the average number of tons per carload of freight, according to the Association of American Railroads. The average was 40.1 tons per car, 1942 thus becoming the fourth consecutive year in which a new high record has been established. In 1941, the average was 38.2 tons and in 1940, it was 37.7 tons.

Pullman to Appeal Court Decree

A THREE-JUDGE expediting court for the District Court for the Eastern district of Pennsylvania handed down its opinion, on April 20, in the government suit against the Pullman Company on charges of alleged violations of the Sherman and the Clayton Acts. Although the court concluded that "there has been a violation of the Sherman Act," it held that the final question is the equitable relief to be had in this suit. As a result it stated that "the formulation of a decree will await further discussion and hearing upon certain points which may be suggested by the parties."

David A. Crawford, president of the Pullman Company, stated, "The opinion of the court in Philadlephia is disappointing, of course, and the Pullman group of companies will take an appeal to the Supreme Court of the United States promptly after a decree is entered. It is our view and that of our counsel that the Philadelphia decision is completely at variance with the evidence which was offered in the trial and also contrary to the applicable principles of the anti-trust laws as passed by Congress and as interpreted by the Supreme Court."

Atomic-Hydrogen Arc Welding Films

A NEW all-color sound movie, "The Inside of Atomic-Hydrogen Arc Welding," has been announced by the General Electric Company to help in the training of men and women welding operators using this process. The movie is available to industrial welding schools, and to other public and private groups.

Produced under the direction of the General Electric welding laboratories, the new film follows the successful pattern of "The Inside of Arc Welding" released last year.

Each of the two parts of the new film employs colorful charts, animation, demonstrations by expert operators and close-ups of the atomic-hydrogen arc in action, as well as examples of good and bad welding. The films are ten minutes in duration and can be used on sound-equipped 16-mm. projectors only.

Part one describes and illustrates the fundamentals of atomic-hydrogen welding. It shows how to regulate the welding current and the hydrogen supply; how to adjust the electrode holder and the tungsten electrodes; and how to recognize and correct improper adjustment.

Part two shows proper technique for principal types of joints; how to control the molten pool; and how to recognize and correct improper welding conditions. Particular emphasis is given these four factors—Current setting, speed of travel, arc size, and the contact of arc with the work.

The film may be obtained for single showings, or bought at print cost, by writing General Electric's Visual Instruction Section, Schenectady, N. Y., or the nearest G. E. office or welding distributor.

Supply Trade Notes

MT. VERNON CAR MFG. CO.—*C. M. Wright* has been appointed chief engineer of the Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., to succeed *T. A. Collison*, retired.

◆

AMERICAN BRAKE SHOE COMPANY.—At the annual stockholders' meeting of the American Brake Shoe & Foundry Company, 230 Park avenue, New York, the company name was shortened to the American Brake Shoe Company.

GRAYBAR ELECTRIC COMPANY.—*W. W. Castleberry*, formerly acting service manager of the Jacksonville, Fla., office of the Graybar Electric Company, has been appointed service manager, with the same headquarters.

◆

ARMSTRONG CORK COMPANY.—*William H. Worrilow*, president of the Lebanon Steel Foundry, has been elected a director of the Armstrong Cork Company. *Robert L. Johnson*, president of Temple University, has also been elected a director.

STANDARD STOKER COMPANY, INC.—*Carl T. Mead* and *T. L. Capps* have been appointed resident manager and service sales engineer, respectively, for the Standard Stoker Company, Inc., with headquarters at Montreal, Que.

◆

PEERLESS MANUFACTURING CORPORATION—*R. B. Stone*, district representative of the Eastern division of the Peerless Manufacturing Corporation, with headquarters at Philadelphia, Pa., has been appointed manager of the Railway division.

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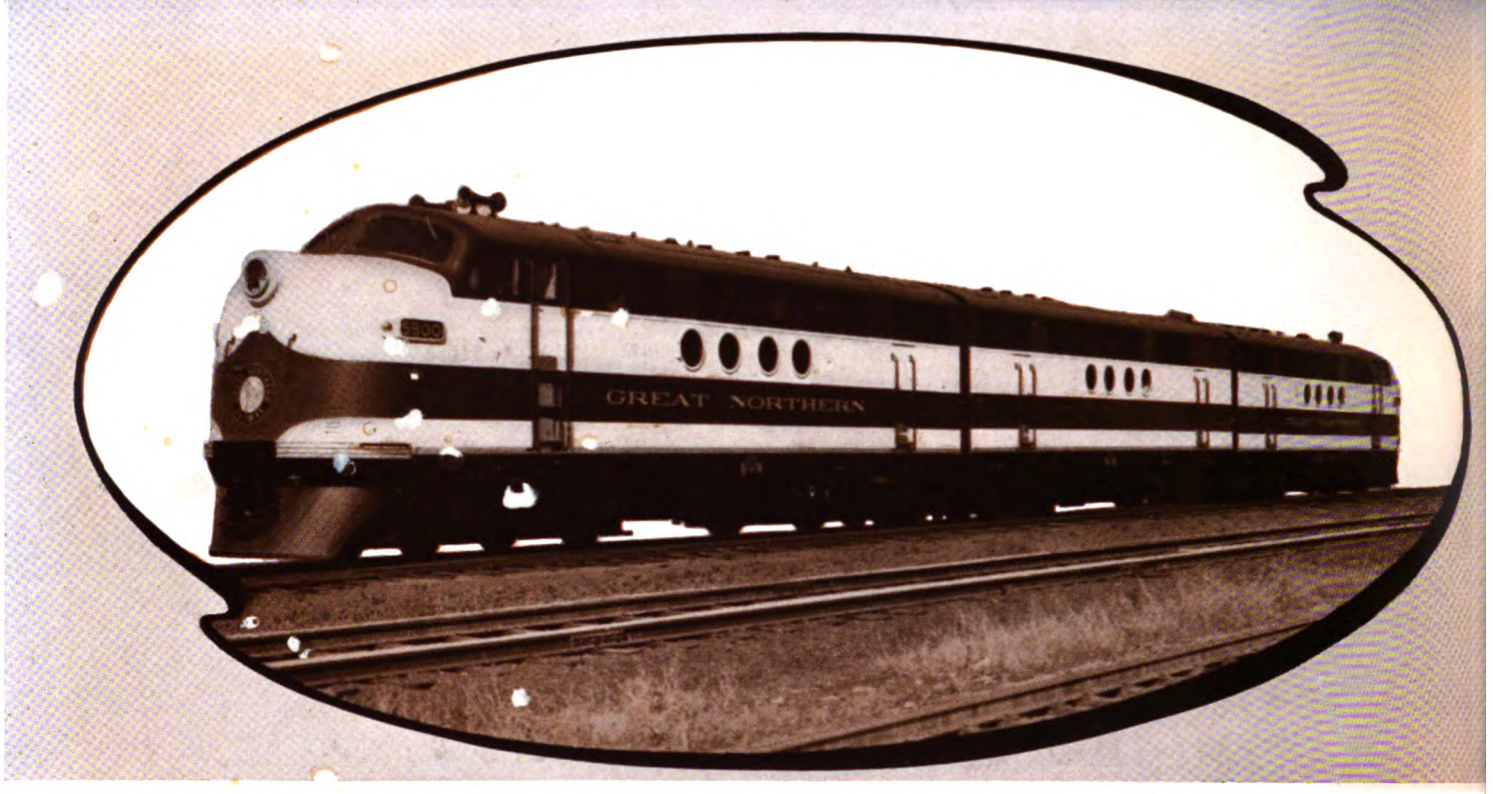


FREIGHT PROGRESS IN 1943

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION LA GRANGE, ILLINOIS, U. S. A.



GENERAL MOTORS *Diesel*

GENERAL MOTORS
LOCOMOTIVES





Freight Locomotives...

DESIGNED FOR PEACE . . . NOW VITAL IN WAR

BUILT to serve America at PEACE, General Motors Diesel Freight Locomotives are doing the important job of serving a World at WAR.

Every stage of production, from the time raw materials leave the ground until the finished products reach their final destination, depends upon ***transportation.*** With the volume of freight traffic exceeding all previous records, the railroads are using all available units of motive power and supporting facilities to the very limit of their capabilities — requiring superior maintenance to obtain peak efficiency and availability.

General Motors Diesel Locomotives, in all classes of service, are playing an important part in the present emergency. Service "Wardens" and eight strategically located parts depots "stand guard" day and night to keep GM Diesels working. Normally, every order for parts leaves the nearest depot within the working day and seldom are replacements more than 24 hours from any GM equipment in service. This long established Electro-Motive Service policy insures receiving the right part — at the right place — at the right time — to "Keep 'Em Rolling."

KEEP THE RAILROADS STRONG





GM LOCOMOTIVES

GENERAL MOTORS
LOCOMOTIVES



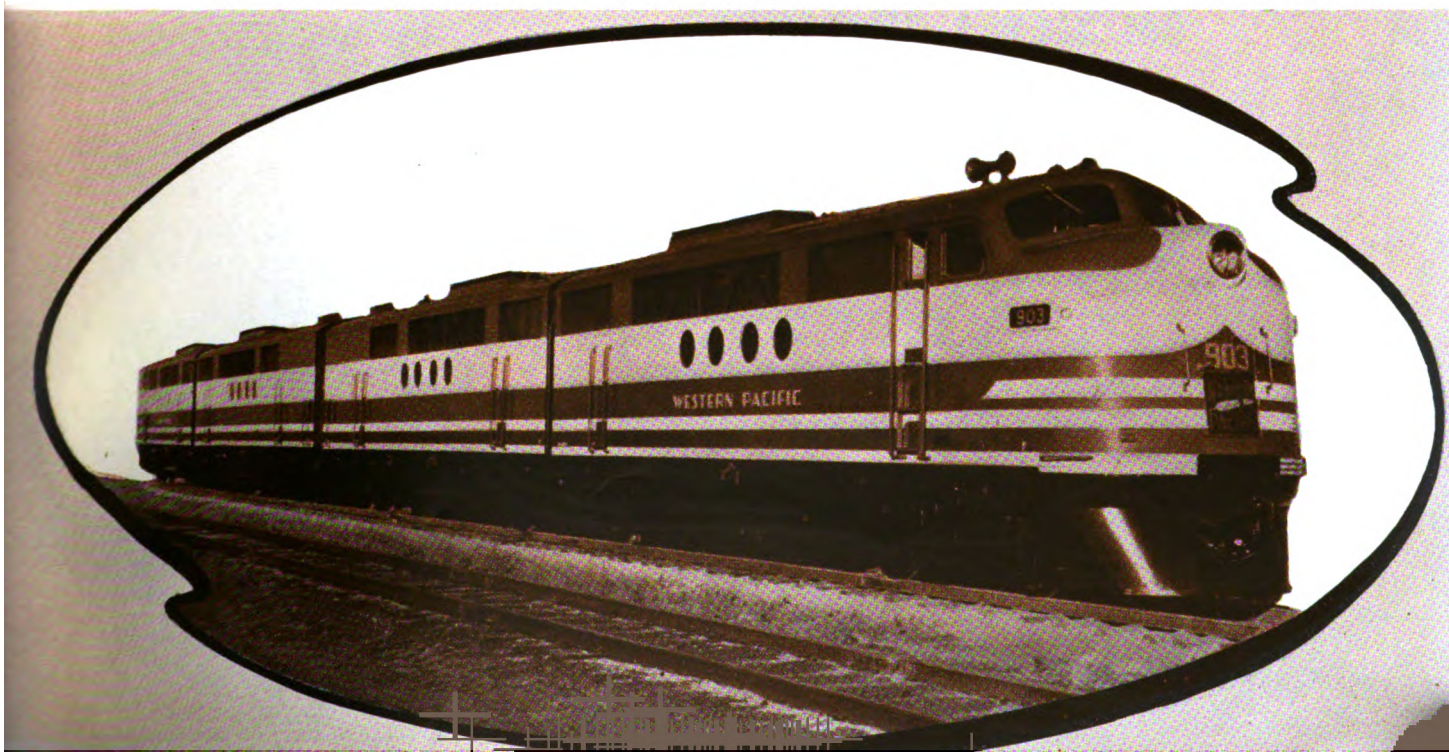


Have What It Takes

TO MEET EVERY CHALLENGE AND SPEED VICTORY

General Motors Diesel Locomotives, totaling 1180 units in all classes of service, have met and will continue to meet every challenge by providing —

Flexibility of operation . . . Faster schedules with maximum safety.
Reduction in train miles . . . Reduction in number of locomotives.
Economical performance . . . Elimination of gas and fire hazards.
Increased revenues . . . Improved tunnel operation.
Greater tonnage capacity . . . Greater operating efficiency.
High availability . . . Helper service minimized.
Track capacity increased without replacements with heavier rail or rebuilding bridge structures.





GM DIESEL SWITCHERS

PREVENT BOTTLENECKS

GM Diesel Switchers prevent costly bottlenecks by speeding up heavy traffic through terminals . . . Between 1938 and 1942, the average revenue carloads handled monthly by the T. R. R. A. of St. Louis increased 100 percent. Such transportation efficiency spells VICTORY . . . made possible by intelligent supervision and the installation of 28 Diesel Switchers, nine of which were built by General Motors . . . This foresight has eliminated any possibility of a power shortage and by continuing present efficiency in locomotive utilization, they will have sufficient power to handle the heavier traffic which is inevitable.

SPEED UP FOR VICTORY

GENERAL MOTORS
LOCOMOTIVES



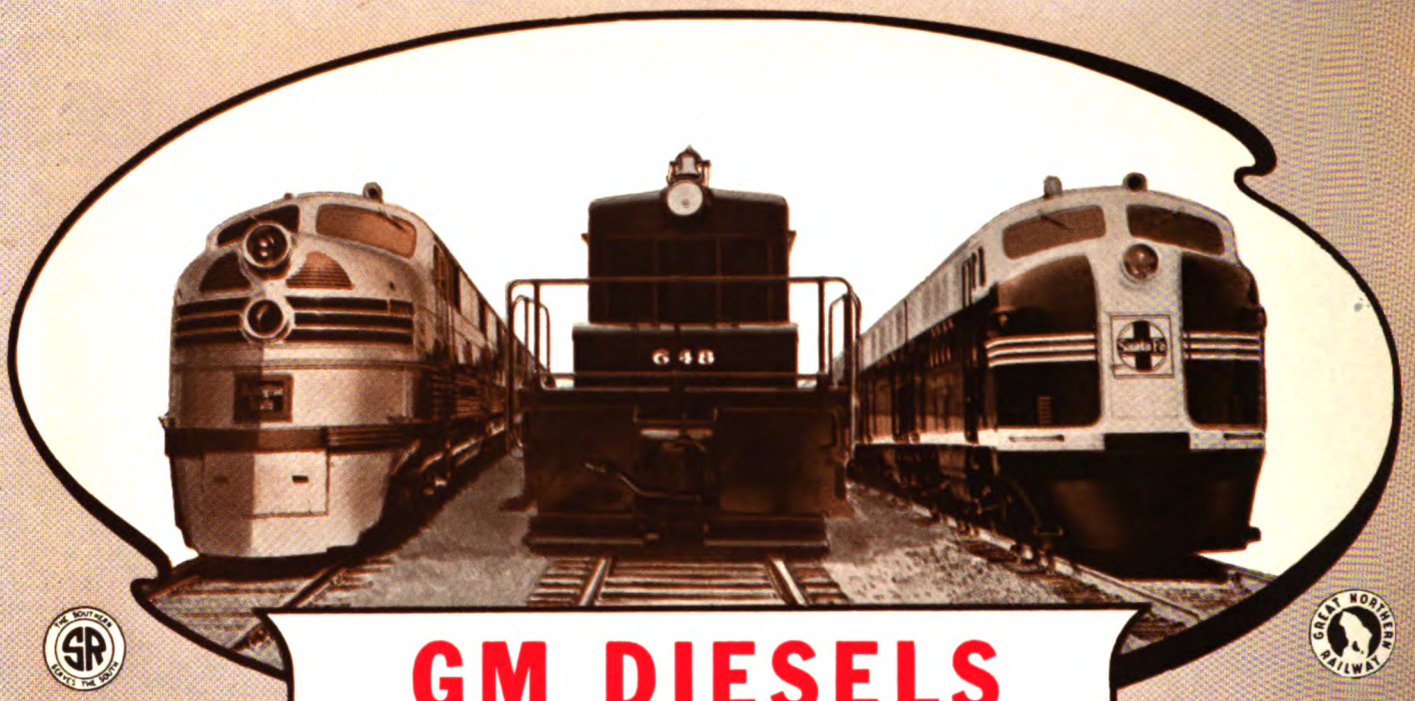
Confidence . .

"State of feeling sure; faith; trust."

All America is united in producing and delivering, with ever-increasing quantities and speed, the materiel so vital to our armed forces. While we on the home front are being called upon to shoulder more and more responsibilities, "privileges" — not burdens, our fighting men throughout the world are giving their all — if needs be their lives. They have faith in us and we must not let them down. Never let it be said, "too little, too late."

KEEP TRANSPORTATION UNSHACKLED

GENERAL MOTORS
LOCOMOTIVES



GM DIESELS
AFTER THE WAR

WHAT transportation problems PEACE will bring to the railroads, no one knows. However, one thing is certain. The super-efficiency demonstrated thus far in the war assures their ability to meet the new forms of competition and other conditions which are certain to appear after the war. Because of America's proven superiority in building planes and ships, it is reasonable to expect a public demand for more extensive improvements in rail equipment and service. But the railroads are not going to relinquish their present leadership in passenger and freight transportation. They are carefully analyzing the entire picture and are planning accordingly. General Motors Diesel Road Locomotives will continue to play an important part by making possible — reduction in train miles — greater hauling capacity — faster schedules with maximum safety — high availability — less wear and tear on rail and bridge structures — lower operating costs — increased revenues.

GENERAL MOTORS LEADS THE WAY

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILLINOIS, U. S. A.

GENERAL MOTORS LOCOMOTIVES

BURLINGTON–ROCK ISLAND
NEW ORLEANS TERMINAL
STEELTON & HIGHSPIRE R. R.
NEW YORK CENTRAL SYSTEM
$00 LINE
201
MONON ROUTE
INTERNATIONAL–GREAT NORTHERN R. R.
BUFFALO CREEK R. R.
CANTON RAILROAD
CENTRAL GEORGIA
HOUSTON BELT & TERMINAL
RIVER TERMINAL RY.
COMMONWEALTH EDISON COMPANY
C. & W. I.
B. & O. C. T.
ST. JOSEPH BELT RY.
FORT WORTH & DENVER CITY
KANSAS CITY TERMINAL RY
CHICAGO SHORT LINE RY. CO.
PATAPSCO & BACK RIVERS
GRAND TRUNK RAILWAY SYSTEM
LAKE CHAMPLAIN & MORIAH
Burlington Route
Rio Grande
SOUTH BUFFALO RY.
PERE MARQUETTE
DONNER-HANNA COKE CORP.
PEORIA TERMINAL CO.
W. & L. E.
PHELPS DODGE CORP.
T.R.R.A.
INLAND STEEL CO.
PHILA., BETHLEHEM & NEW ENGLAND
BOSTON & MAINE
NICKEL PLATE ROAD
Reading Lines
GREAT LAKES STEEL CORP.
ILLINOIS CENTRAL
CINCINNATI, NEW ORLEANS & TEXAS PACIFIC RY.
U. S. NAVY
HANNA FURNACE CORP
B & O
MEMPHIS UNION STATION CO.
ST. JOHNS RIVER TERMINAL
MAINE CENTRAL RAILROAD
U. S. ARMY
Rock Island
L & N
SOUTHERN PACIFIC LINES
Santa Fe
NORTHERN PACIFIC
REPUBLIC STEEL CORP.
THE DIXIE LINE
C & E I

AMERICAN HOIST & DERRICK COMPANY.—The American Hoist & Derrick Company has moved its Chicago office from 208 W. Washington street to the Conway building, 111 W. Washington street.

◆

L. C. CHASE & COMPANY.—*H. Arnold Giles* has been appointed manager of the general transportation division of L. C. Chase & Co., New York, succeeding *Eldon R. Campbell,* who has resigned. Mr. Giles has been with the company 21 years, being directly associated with its Velmo fabric division and, in later years, concentrating on the bus and aircraft division.

◆

MIDVALE COMPANY.—*Francis Bradley,* formerly vice-president, has been elected president of the Midvale Company, Philadelphia, Pa., to succeed *Harry L. Frevert,* who has been elected to the position of chairman of the board. *George E. Smith,* general superintendent of the company, was elected vice-president to succeed Mr. Bradley. *Ralph Kelly,* president of the Baldwin Locomotive Works, was elected a director of the Midvale Company, and *Charles E. Brinley, Edward Hopkinson, Jr.,* and *James E. Gowen* were elected to serve as an executive committee, with Mr. Frevert and Mr. Bradley members ex officio.

◆

OXWELD RAILROAD SERVICE COMPANY.—*Richard W. Torbert,* assistant chief engineer of the Oxweld Railroad Service Company, Chicago, has been appointed assistant to vice-president, engineer. Mr. Torbert will have active charge of service operations in maintenance-of-way and structures work. He was born in Ocean City, N. J., on December 1, 1902, and graduated in civil engineering from the University of Delaware in 1926. He entered railroad service in the engineering department of the Reading at Harrisburg, Pa., and was promoted



R. W. Torbert

to the position of assistant supervisor of track in November, 1926. He was appointed supervisor of track in April, 1934, and continued as such at Philadelphia, Pa., and West Trenton, N. J., until December, 1941, when he joined the Oxweld Railroad Service Company as assistant chief engineer.

JOSEPH T. RYERSON & SON, INC.—*Wayne D. Dukette,* for the last seven years assistant sales manager of the Ryerson Chicago Steel Service plant, has been ap-



Wayne D. Dukette

pointed manager of the railroad sales department of Joseph T. Ryerson and Son, Inc., Chicago. He succeeds *J. P. Moses,* who will continue in the railroad sales organization in an advisory capacity.

◆

AMERICAN ROLLING MILL COMPANY.—*J. B. Tytus,* vice-president in charge of operations of the American Rolling Mill Company, has been elected vice-president in charge of technical development and *F. E. Vigor,* who has been assistant director of the Steel division of the War Production Board has been elected vice-president in charge of manufacturing and mining operations.

J. B. Tytus, who graduated from Yale in 1897, started to work in the Armco sheet mills in 1904 as a doubler. He became superintendent of the Zanesville Armco plant in 1906, and superintendent of the Middletown sheet mill department in 1909. He was appointed assistant general superintendent in 1918. During World War I, Mr. Tytus conducted a series of experiments on the continuous rolling of iron and steel sheets, and in 1922, he built a continuous sheet rolling mill in Ashland, Ky. He was elected vice-president in 1927.

◆

OKONITE COMPANY; OKONITE-CALLENDER CABLE COMPANY.—*E. D. Youmans* has been elected vice-president and technical director of the Okonite Company, Passaic, N. J. He has also been elected to the same position in the Okonite-Callender Cable Co., Inc., of Paterson, N. J. The Okonite Company has established a sales office at 904 Pere Marquette building, New Orleans, La., in charge of *W. D. Stroud,* sales engineer. The territory of this new office includes Louisiana, Southern Mississippi, and northwest Florida.

E. D. Youmans, the new vice-president and director of Okonite and Okonite-Callender, was formerly technical manager of the Okonite Company's research laboratory. He will now have charge of co-ordinating the entire technical research of these two organizations, and also of Okonite's Hazard Insulated Wire Works Division in Wilkes-Barre, Pa. Mr. Youmans started to work in the Okonite laboratories in 1913, at the same time securing his chemical education by attending evening classes at the Brooklyn Polytechnic Institute. He was appointed technical manager of Okonite in 1928 and has taken an active part in the preparation of standards and specifications in the National Electrical Manufacturers Association, the American Society for Testing Materials, and the American Standards Association, having served as chairman of numerous committees in these organizations. He also did considerable work on the wire and cable requirements of the 1940 Edition of the National Electrical Code and is now co-operating with the War Production Board Rubber Director's Office, the U. S. Navy, and the U. S. Army, in connection with the conservation of rubber.

◆

PHILCO CORPORATION.—*John Ballantyne,* vice-president in charge of operations of the Philco Corporation, has been elected president of the company, succeeding *James T. Buckley,* who has been elected to the newly-created office of chairman of the company's Executive Committee. *M. W. Heinritz,* general manager, has been appointed vice-president in charge of the company's Storage Battery division, and *Charles F. Steinruck, Jr.,* assistant secretary was elected secretary, to succeed the late George E. Deming.

◆

YOUNGSTOWN STEEL DOOR COMPANY.—*Carl E. Johansson,* assistant to the engineer of car construction and mechanical assistant to the chief mechanical officer of the Chesapeake & Ohio, the New York Central and the Pere Marquette, has resigned to become assistant to the chief engineer of the Youngstown Steel Door Company. Mr. Johansson was born in Hoganas, Sweden, on November 23, 1896, and was educated at Malmo Technical Col-



Carl E. Johansson

lege, Malmo, Sweden. He began his business career in this country in 1928 with the Kuhlman Car Company. He subsequently had additional engineering experience with the White Motor Company, and in 1935 joined the Nickel Plate in the office of engineer of rolling stock. He served

with the Advisory Mechanical Committee for the Van Sweringen roads as draftsman; in 1937 became chief draftsman, and in 1943 was appointed assistant to the engineer of car construction and mechanical assistant to the chief mechanical officer.

◆

NATIONAL BATTERY COMPANY.— *Alfred Sedgwick* has been elected vice-president and comptroller of the National Battery



Alfred Sedgwick

Company, St. Paul, Minn. Mr. Sedgwick joined the company in February, 1938. Prior to that time he was comptroller of the Waypoyset Manufacturing Company of Pawtucket, R. I., for eight years. From 1920 to 1930 he was working in various locations and capacities for Stone and Webster, Boston, Mass.

◆

R. K. LEBLOND MACHINE TOOL CO.— *Bernard N. Brockman* has been appointed vice-president and general sales manager of The R. K. LeBlond Machine Tool Company, Cincinnati, Ohio. For the past eight



B. N. Brockman

years Mr. Brockman has been in charge of the company's Chicago office. Prior to the opening of this office, he was for sixteen years with the Federal Machinery Sales Co., the LeBlond representative. During the previous five years he was in the manufacturing and inspection departments at the Cincinnati plant. *Donald Whitacre* will succeed Mr. Brockman in charge of the Chicago Office. Mr. Whitacre has been with the LeBlond organization for seventeen years and in the Chicago Office since it was opened in 1935.

◆

WILLIAM SELLERS & CO., INC.—*William H. Harman* has resigned as vice-president in charge of sales of the Baldwin Locomotive Works to become president of Wm. Sellers & Co., Philadelphia, Pa. In 1894 Mr. Harman joined R. D. Wood & Co., remaining with that company until 1915, when he left the position as sales manager of the hydraulic machinery division to become president of the Southwark Foundry & Machine Co. In 1929 he became vice-



William H. Harman

president and general manager of the Baldwin - Southwark Corporation, coincident with the merging of the two companies, and in December, 1938, was elected also vice-president in charge of sales of the Baldwin Locomotive Works. Mr. Harman will continue as a member of the board of directors of the Baldwin Locomotive Works.

◆

MACLEAN-FOGG LOCK NUT COMPANY.— *L. A. Rowe,* special representative, and *A. W. MacLean,* Southern sales manager, of the MacLean-Fogg Lock Nut Company, Chicago, have been elected vice-presidents; *Ernest G. Doke,* engineer, has been promoted to the position of assistant to president and *Joseph J. Murphy* has been appointed special representative.

Army-Navy E Awards

Baldwin Locomotive Works, Eddystone, Pa. April 16.

Chicago Flexible Shaft Company, Chicago. April 22.

Cincinnati Planer Company, Cincinnati, Ohio. April 29.

Firth Sterling Steel Company, McKeesport, Pa. May 7.

Lufkin Rule Company, Saginaw, Mich.

Rockford Machine Tool Company, Rockford, Ill. April 28.

Whiting Corporation, Harvey, Ill. April 20.

Worthington Pump & Machinery Corp., Wellsville, N. Y. March 12.

L. A. Rowe attended the engineering school of Iowa State College, Ames, Ia., and later entered the employ of the Pacific Electric at Los Angeles, Calif. From 1916 to 1919 he was employed in the me-



L. A. Rowe

chanical department of the Atchison, Topeka & Santa Fe, and from 1919 to 1930 was with the Spring Packing Corporation. In 1934 he was appointed a special representative of the MacLean-Fogg Lock Nut Company.

A. W. MacLean entered the railway supply business with the Boss Nut Company, Chicago, in 1913. He became associated with the MacLean-Fogg organization in



A. W. MacLean

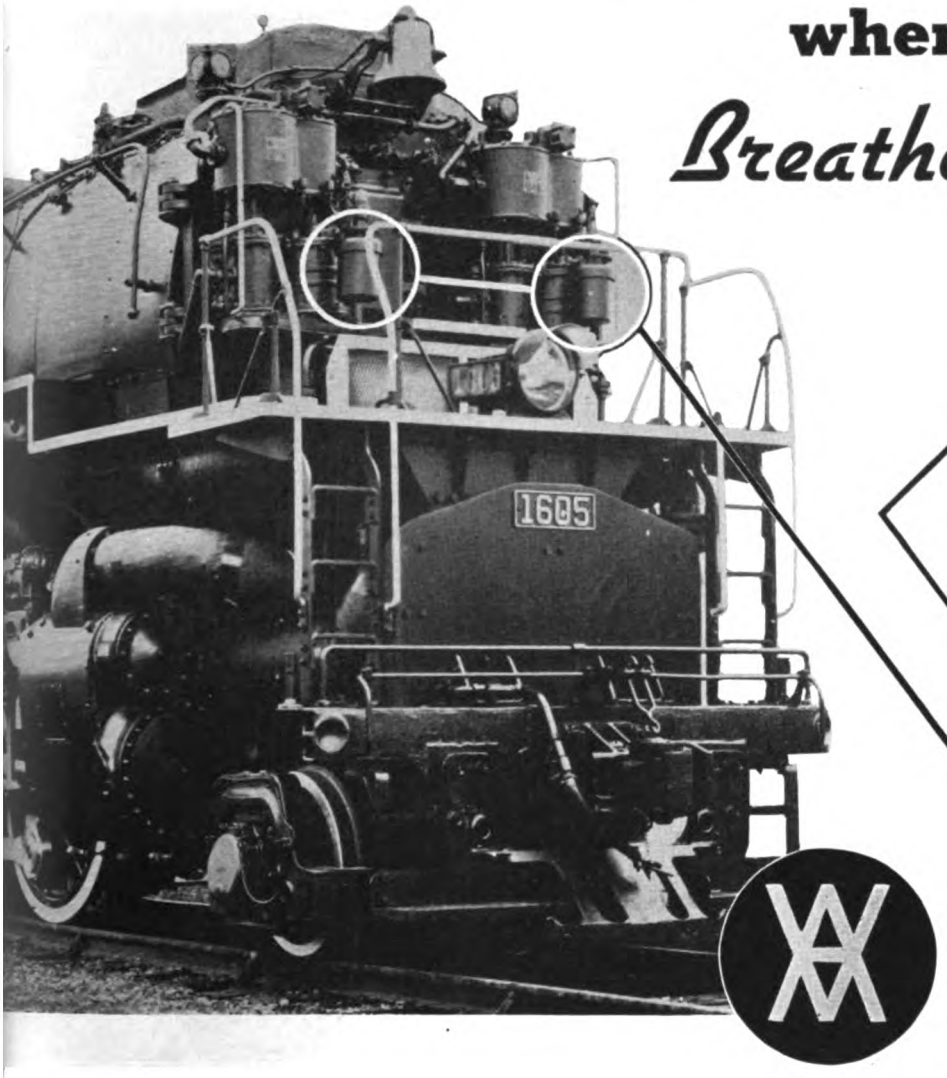
1928 and in 1932 was appointed Southwestern sales manager. In 1941 he became Southern sales manager.

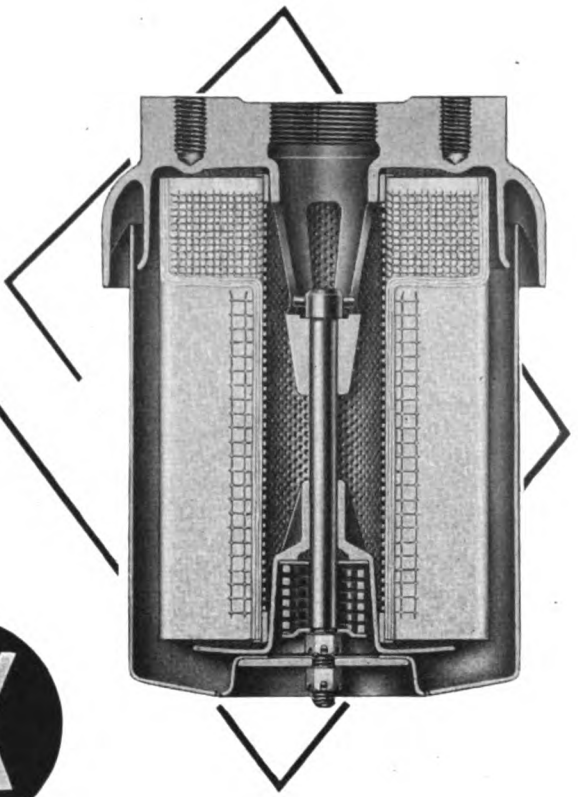
Ernest G. Doke was graduated from Purdue University in 1937 and immediately entered the railway supply business. In 1940 he was appointed engineer of the MacLean-Fogg organization.

Joseph J. Murphy was graduated from Dartmouth College in 1925 and spent several years in the advertising and the securities businesses. He entered the railway supply business in 1940, selling asphalt specialty products in the railway and marine fields. He entered the employ of the MacLean-Fogg Lock Nut Company on April 1, 1943.

(Turn to next left-hand page)

Air Brake
Life and Vitality are Sustained
when Compressors
Breathe Clean Air





NOW, when all railroad equipment is being subjected to intensive service in the effort to meet urgent transportation requirements, Air Brakes are being given their share of hard usage Inherently sturdy and reliable, they need be given only reasonable care to preserve their functional integrity. ★ One important consideration is a means to assure that the compressor will breathe clean air—such as is provided by the modern inlet Filter This is very effective in precipitating heavy dirt particles and intercepting fine dust. Moving parts are thus kept working freely, air passages open, valves tight. Many railroads have thereby eliminated faulty or erratic compressor operation, and materially extended service life. ★ This Filter can be readily applied to compressors now in service. For such it will prove to be a low cost means to assure satisfactory performance over long operating periods. The higher degree of brake reliability thus maintained will materially aid in expediting the movement of vital traffic » » » » » »

WESTINGHOUSE AIR BRAKE CO.

WILMERDING, PENNSYLVANIA

Obituary

HERBERT G. COOK, railway supply representative at San Francisco, Calif., died on April 18 of a heart ailment.

◆

F. O. BRAZIER, general manager of railway sales of the Murphy Varnish Company, died on May 1. He was 69 years of age.

◆

AUGUST T. SEBELIEN, secretary and treasurer of the Davenport-Besler Corporation, Davenport, Ia., died on April 6.

◆

CLARENCE E. POSTLETHWAITE, retired assistant vice-president of the Pressed Steel Car Company, Inc., at New York, died at his home in New Rochelle, N. Y., on April 15 at the age of 77. Mr. Postlethwaite was born in Mount Union, Pa., and began his career as rodman for the Pennsylvania. Later he joined the Norfolk & Western and in 1897 he entered the employ of the Schoen Pressed Steel Company, the first manufacturers of fabricated steel freight cars. This firm was merged with the Pressed Steel Car Company in 1898 and in 1915 Mr. Postlethwaite became general sales manager of the latter company. He was appointed assistant vice-president in 1929 and the following year retired from active service.



Clarence E. Postlethwaite

◆

FRED S. DENISON, engineering executive of the Minneapolis-Honeywell Regulator Company, died on April 18 at Minneapolis, Minn. He was 56 years of age. Born in Green Leaf, Kan., Mr. Denison joined the Minneapolis-Honeywell organization in 1908 and soon became the first member of the engineering department of the company. He left his position as chief engineer to act in a consulting engineering capacity for the sales and engineering departments, and was recently engaged in the active superintendence of the Lake Street ordnance plant. In 1940, Mr. Denison was the winner of the National Association of Manufacturers' Pioneer award, given in recognition of his contributions to industry, science and invention.

Personal Mention

General

DUMONT LOVE, superintendent of air brakes of the Florida East Coast, has been appointed general mechanical inspector, with headquarters at St. Augustine, Fla.

NICHOLAS MCLEAN TRAPNELL, assistant superintendent motive power of the Chesapeake & Ohio, has been appointed superintendent motive power, with headquarters as before at Richmond, Va. Mr. Trapnell, who was born on December 30, 1900, at Elizabeth, N. J., was graduated from Stevens Preparatory school, Hoboken, N. J., and studied mechanical engineering at the Stevens Institute of Technology. He entered railway service as a locomotive fireman on the New York division of the Pennsylvania during the summer vacation of 1916, and was employed by the same road in a like capacity during his summer vacation periods of 1917 and 1918. In July, 1919, he became a machinist helper of the Coal & Coke (now Baltimore & Ohio) at Gassaway, W. Va., and in February, 1921, joined the staff of the Barber Steamship Company as a marine engineer. In April, 1922, he was appointed machinist, Meadow shops, New York division of the Pennsylvania, and in September, 1924, entered the employ of the Weston Electrical Instrument Company as draftsman at Newark, N. J. He became mechanical engineer of the latter firm in 1926. In December, 1928, Mr. Trapnell was appointed assistant engineer, operating department, of the Chesapeake & Ohio, at Richmond, and special engineer on the staff of the vice-president and general manager in April, 1933. He was appointed mechanical engineer in August, 1936, in June, 1938, assistant to superintendent motive power, and in October, 1938, assistant superintendent motive power.



Nicholas McLean Trapnell

CLYDE B. HITCH, superintendent of motive power of the Chesapeake & Ohio at Richmond, Va., has been appointed chief mechanical officer of the C. & O., succeeding D. S. Ellis, who has resigned as chief mechanical officer of the C. & O., the Pere Marquette, and the New York, Chicago & St. Louis. Mr. Hitch was born on November 19, 1881, at Terre Haute, Ind. After receiving a high school education he entered railway service as a machinist apprentice on the Vandalia (now part of the Pennsylvania) at Terre Haute, completing his apprenticeship in 1900. He later served as a machinist on the Pere Marquette, the Louisville & Nashville, the Iron Mountain (now part of Missouri Pacific), the Southern and the Chicago & Eastern Illinois. Mr. Hitch entered the service of the Chesapeake & Ohio in 1902 as a machinist at Lexington, Ky. In 1909 he was appointed general foreman at Lexington, being transferred to the Covington shops at Covington, Ky., in 1910 and to the Hinton (W. Va.) shops in 1913. In 1920, Mr. Hitch became master mechanic at Clifton Forge, Va., and was transferred to the Cincinnati and Northern divisions in 1923, and to Russell, Ky., with jurisdiction over the Cincinnati, Northern and Russell divisions in 1930. Later in 1930, he was appointed general master mechanic at Huntington, W. Va. In 1934 he became assistant superintendent of motive power at Huntington, and in October, 1938, superintendent of motive power at Richmond.



Clyde B. Hitch

THOMAS C. SHORTT, superintendent of motive power of the New York, Chicago & St. Louis at Cleveland, Ohio, has been appointed chief mechanical officer of the N. Y. C. & St. L., succeeding D. S. Ellis, who has resigned as chief mechanical officer of the C. & O., the Pere Marquette, and the N. Y. C. & St. L. Mr. Shortt was

born at Crewe, Va., on December 9, 1888, and entered railway service as an apprentice of the Norfolk & Western at Crewe. He served in various capacities on the Atlantic Coast Line, the Norfolk & Southern and the Norfolk & Western until 1914 when he was appointed enginehouse fore-



Thomas C. Shortt

man of the Seaboard. One year later Mr. Shortt returned to the N. & W. as assistant foreman at Petersburg, Va., and in 1923 became a machinist of the Chesapeake & Ohio, subsequently serving as foreman, chief inspector and supervisor of reclamation. In July, 1933, he was appointed assistant to the superintendent of motive power of the Nickel Plate at Cleveland, Ohio, and in June, 1942, superintendent of motive power at Cleveland.

RICHARD J. WILLIAMS, superintendent of motive power of the Pere Marquette at Detroit, Mich., has been appointed chief mechanical officer of the Pere Marquette, succeeding D. S. Ellis, who has resigned as chief mechanical officer of the Chesapeake & Ohio, the Pere Marquette, and the New York, Chicago & St. Louis. Mr. Williams was born at Indianapolis, Ind.,



Richard J. Williams

in 1880, and graduated from Purdue in 1905. He entered railway service in 1899 as a helper in the engineering corps of the Peoria & Eastern (now part of the New York Central system), and in 1905 joined the mechanical division of Isthmus Canal Commission at Panama. One year later Mr. Williams became a special apprentice of the Cleveland, Cincinnati, Chicago & St. Louis (now part of the New York Central system), subsequently becoming shop superintendent. In 1916 he was appointed assistant superintendent of motive power of the Missouri-Kansas-Texas and in 1917 superintendent of motive power of the Pere Marquette at Detroit.

L. D. RICHARDS, superintendent of shops of the Chicago, Rock Island & Pacific, has been appointed assistant general superintendent of motive power, with headquarters as before at Silvis, Ill.

Master Mechanics and Road Foremen

H. D. EDDY, master mechanic of the Atchison, Topeka & Santa Fe at Winslow, Ariz., has been transferred to the position of master mechanic at Needles, Calif.

A. H. JOHNSTONE, who has been appointed master mechanic of the Rio Grande division of the Southern Pacific at El Paso, Tex., as announced in the May issue, was born on November 11, 1894, at Marysville, Mo. He attended high school at Portland,



A. H. Johnstone

Ore., and the Oregon Agricultural College for one year. On April 1, 1911, he became a machinist apprentice in the employ of the Atchison, Topeka & Santa Fe at San Bernardino, Calif. On July 4, 1911, he entered the service of the Southern Pacific as a machinist at Bakersfield, Calif. He was with the U. S. Navy on submarine duty from April 15, 1917, to November 29, 1919. In 1920 he was appointed enginehouse foreman of the Southern Pacific at Bakersfield; in 1941, became general foreman at Bakersfield; in October, 1942, was appointed assistant master mechanic at Oakland, Calif., and on April 1, 1943, was transferred to the position of master mechanic at El Paso.

M. F. SMITH, master mechanic of the Atchison, Topeka & Santa Fe at Needles, Calif., has been transferred to the position of master mechanic at Fresno, Calif.

J. C. HANSSEN, assistant master mechanic of the Southern Pacific at Roseville, Cal., has been appointed master mechanic, with headquarters at Sparks, Nev. Mr. Hanssen will have jurisdiction over that part of the Salt Lake division west of Carlin, Nev.

H. V. GILL, master mechanic of the Atchison, Topeka & Santa Fe at Chicago, has been transferred to the position of master mechanic at Winslow, Ariz.

H. L. PRICE, master mechanic of the Atchison, Topeka & Santa Fe at Chanute, Kan., has been transferred to the position of master mechanic at Chicago.

WILLIAM A. BIRCH, division foreman of the Atchison, Topeka & Santa Fe at Barstow, Cal., has been appointed master mechanic, with headquarters at Chanute, Kan.

Car Department

H. A. RYAN, general car foreman of the Delaware, Lackawanna & Western at Buffalo, N. Y., has been appointed general car inspector, with headquarters at Scranton, Pa.

REED HAAG, supervisor car inspection and maintenance of the Delaware, Lackawanna & Western at Scranton, Pa., has been appointed general car foreman at Buffalo, N. Y., with jurisdiction over the Buffalo division.

T. H. HOLLEN has been appointed general car foreman of the Baltimore & Ohio, with jurisdiction over the Monongah and Wheeling divisions and headquarters at Benwood, W. Va.

LOUIS PINGTELL, car inspector, Pittsburgh Division, of the Pennsylvania, has been promoted to the position of gang foreman, Conemaugh car shop.

Shop and Enginehouse

M. J. O'LEARY, boiler inspector, Mingo Junction, of the Pennsylvania, has been promoted to the position of gang foreman, boiler shop, Mingo Junction.

H. G. NOBLE, gang foreman, Mingo Junction, of the Pennsylvania, has been promoted to the position of boiler foreman, Eastern Ohio and Lake Divisions.

ROY W. HARTER, process supervisor of the Chicago, Rock Island & Pacific, has been appointed superintendent of shops at Silvis, Ill.

Purchasing and Stores

A. E. JOHNSON, fuel agent of Chicago, Milwaukee, St. Paul & Pacific, has been promoted to assistant to the chief purchasing agent, with headquarters as before at Chicago.

N. C. JOHNSON, assistant purchasing agent of the Nashville, Chattanooga & St. Louis, has been appointed purchasing agent, with headquarters as before at Nashville, Tenn.

Obituary

GEORGE CLINTON CHRISTY, general superintendent of equipment of the Illinois Central who retired on December 1, 1941, died at Chicago on March 18. A photograph of Mr. Christy and a sketch of his career appeared on page 42 of the January, 1942, issue of the *Railway Mechanical Engineer*, at the time of his retirement.

READY FOR THE BIG

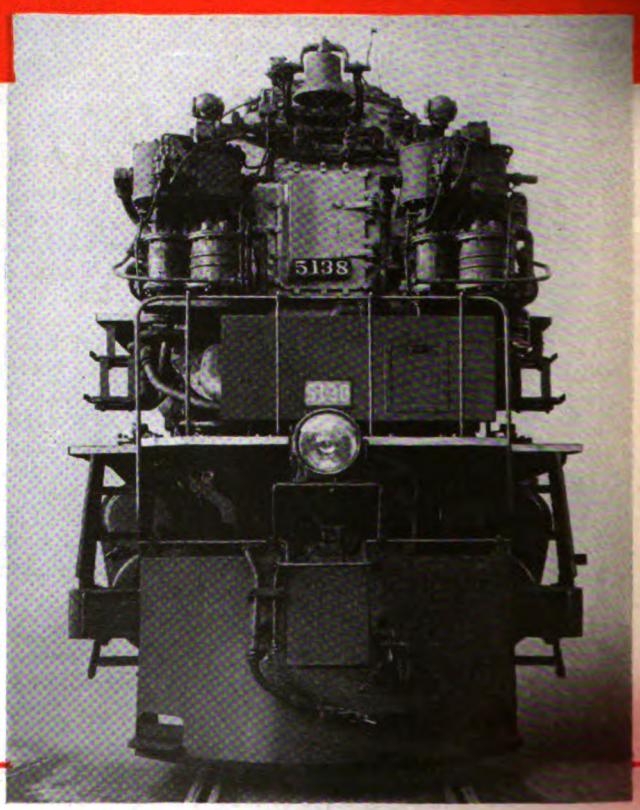
ON THE



NORTHE
PACIFI
YELLOWSTONE PARK LINE

Locomotive Characteristics

Weight on Drivers	440,000 Lb.
Weight of Engine	644,000 Lb.
Cylinders (Four)	23 x 32 Ins.
Diameter of Drivers	70 Ins.
Boiler Pressure	260 Lb.
Tractive Power	106,900 Lb.
Tender Capacity—Fuel	27 Tons
Tender Capacity—Water	25,000 Gals.



★ ★ ★ ★ ★ ★ ★ ★

FOR VICTORY BUY U. S. WAR BONDS AND STAMPS

Anderson

PLUGS AND RECEPTACLES

Help Speed Up Battery Charging In Passenger Car Yards





A VAST increase in war traffic necessitated enlarging the facilities of the Jacksonville Terminal Company's passenger yard and to cope with it a new system of power supply was installed for charging car batteries. A feature of the new layout includes Anderson Plugs and Receptacles which are used exclusively on the fourteen charging sets and numerous connections. This assures trouble free service, for all Anderson equipment is made to stand up under the stress of abnormal conditions.

Anderson Plugs and Receptacles are designed and employed advantageously in the following railroad work, Air Conditioning, Battery Charging, Marker Lights, Yard Receptacles, Platform Receptacles, Portable Tools, Telephones, Switchboards, Welding, Cable Connectors, Couplers, Watertight Plugs and Receptacles, Turntables and Industrial Trucks.

ALBERT and J.M. ANDERSON MFG. CO.

289-305 A Street, Boston, Mass.

NEW YORK CHICAGO PHILADELPHIA LONDON

No. 11 in a series of tips on "Keeping 'em Turning" by Arthur Edwards — 41 years at LeBlond.

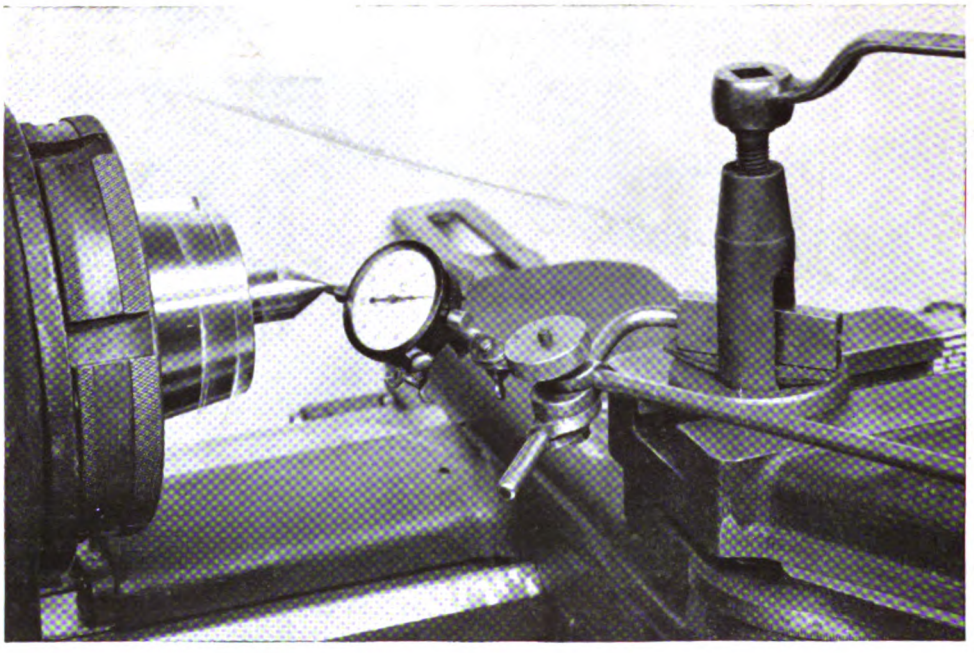
I'm tellin' you.



"A straight line is the shortest distance between two points. That's the way your lathe spindles should run to turn out a good job — in a straight line. Centers can get out of whack even the best of them, under continued hard use. We call it "run-out" when the headstock center rotates out of line.

"Run-out" shows up easily if you use a dial type indicator measuring in thousandths of an inch. Here's how to detect and correct it.

Mount the dial indicator on the tool post with the point against the angle of the lathe center. Fluctuation of the needle when the spindle is turning indicates "run-out". Three things may be responsible.



1 — Most likely to be the fault is the presence of dirt or chips in the taper hole between spindle and center bushing or between center bushing and the center itself. Remove the center and center bushing and clean the taper holes in the spindle and center bushing and the outside of both center bushing and center.

2 — A second source of trouble may be a burr or scratch on the surface of the spindle taper hole or the center bushing. Since the center bushing is hardened, the burr is most likely to be in the spindle hole. In this case, remove the high spot with a scraper or use a Morse taper reamer of appropriate size.

3 — Third cause of "run-out" is inaccuracy of the center point itself. Soft centers can be trued up by setting the compound rest at 30 degrees with the axis of the lathe and taking a skim cut with a sharp tool. Hard centers require grinding. Use a tool post grinder or a LeBlond grinding attachment, mounted at 30 degree angle.

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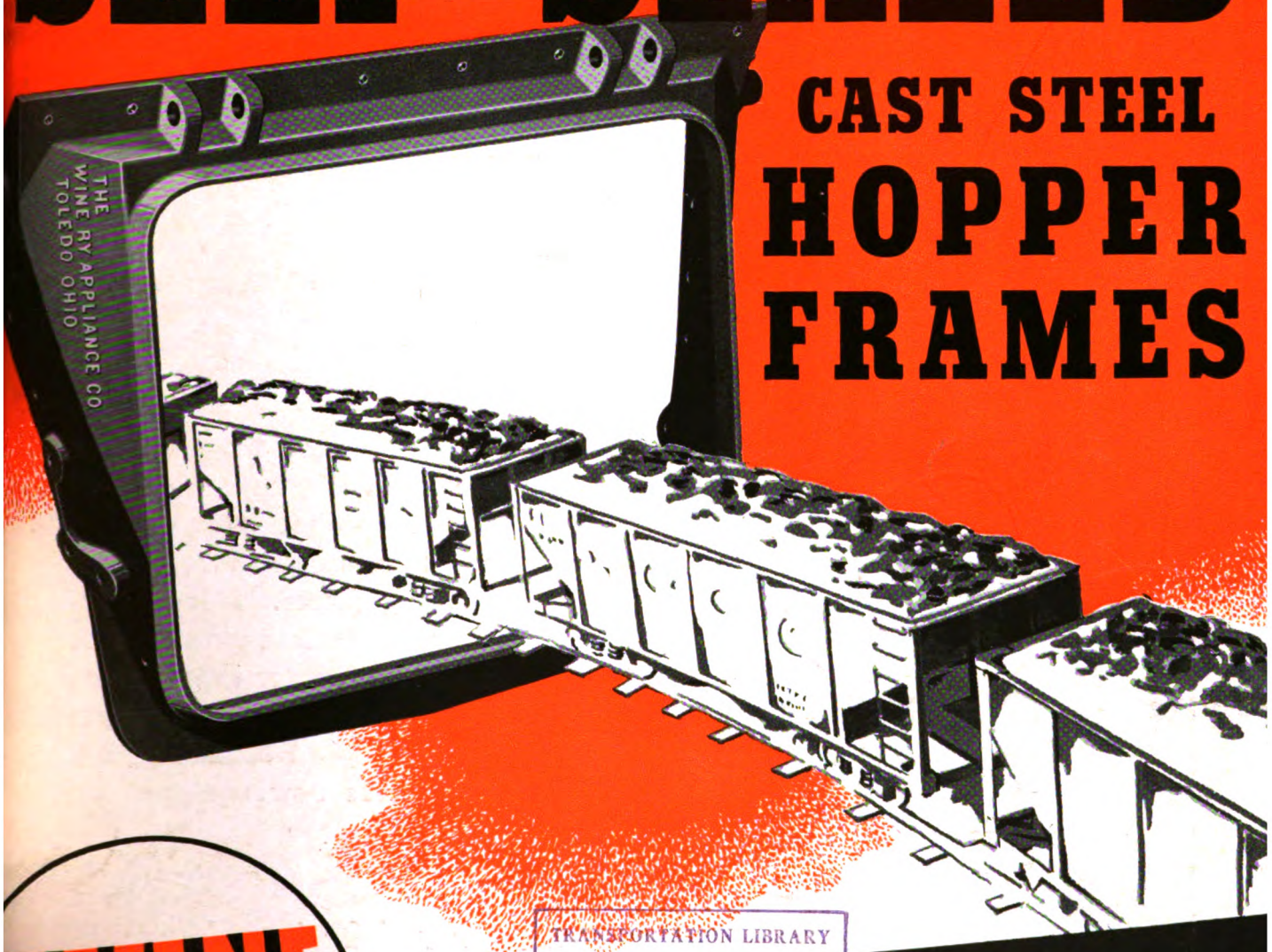
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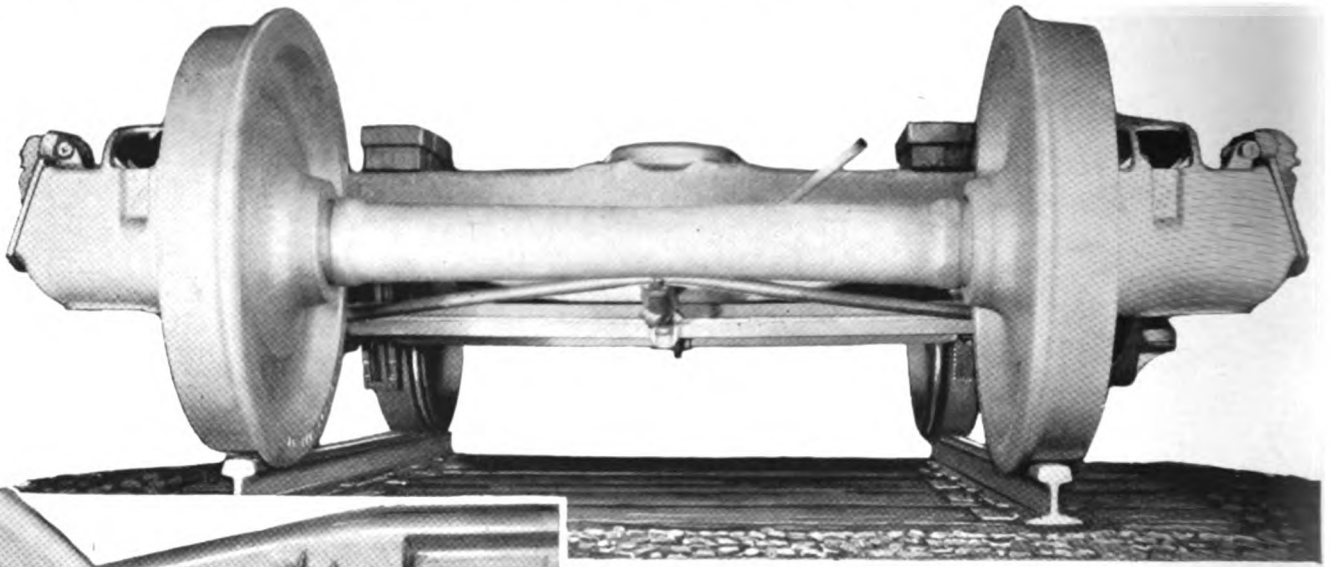


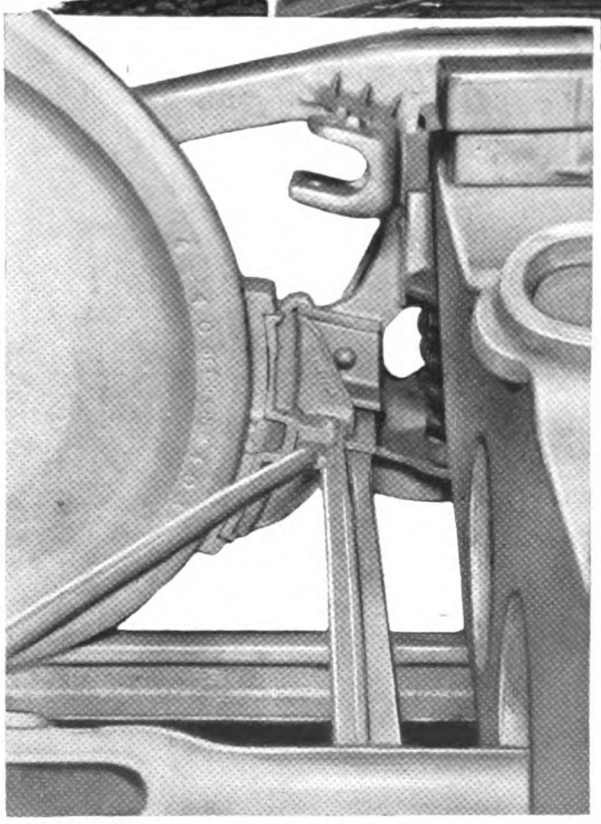
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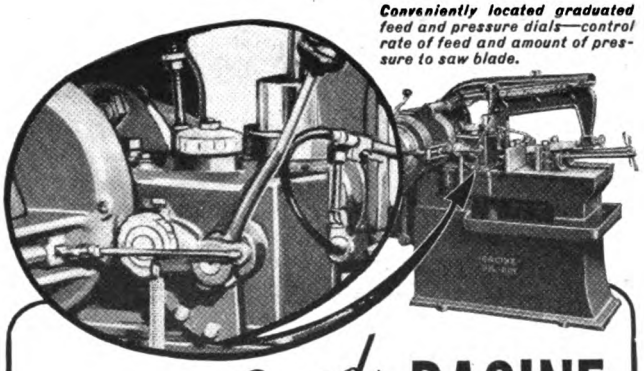
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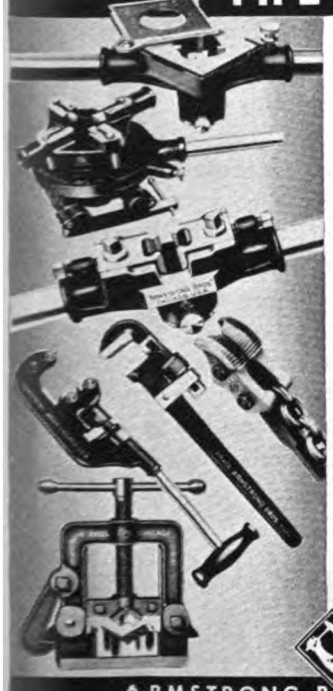
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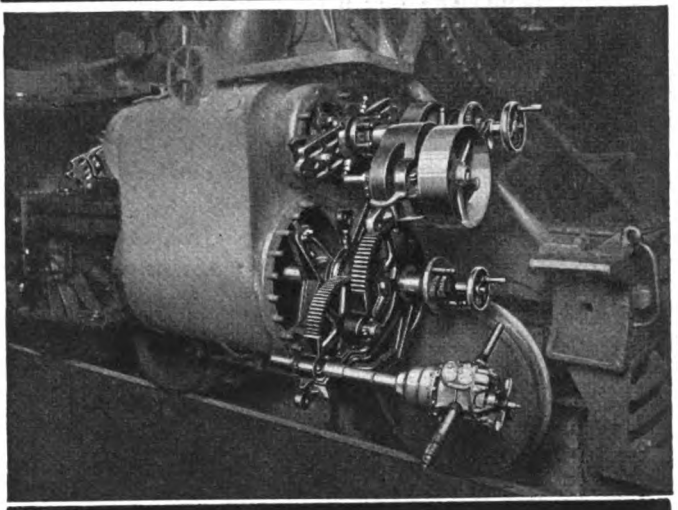
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THE EDITOR'S DESK

PRODUCTION MUST BE SPEEDED UP

Malicious propaganda, the effects of the so-called fluidity of war, and erroneous impressions on the part of the public regarding the size of the job still to be done, may greatly prolong the conflict and cause unnecessary loss of lives and property, if the war production program is thereby slowed down.

The enemy, like ourselves, is constantly experimenting and bringing out new equipment and more destructive devices. These sometimes mean that radical changes must be made in order successfully to meet and overcome these new developments. In turn, they may mean entirely discarding or radically redesigning a piece of armament or fighting equipment. It is not strange if the workers who may be temporarily displaced or left idle while the necessary changes in production are being made, feel that it is an indication of a permanent slowing down of war production. This is particularly true if it occurs at a time when the newspapers and radio are heralding victories or favorable progress for our side.

The war, however, will not be won that easily. The success in North Africa and in overcoming the islands in the Mediterranean is only the beginning of the great offensive, which almost certainly will extend over many months and possibly over years.

In the first six months of this year we achieved only about 40 per cent of the war production goal established for the year 1943. To achieve it fully, the rate of production during the second half of this year must be 50 per cent greater than during the first six months. There will be necessary slowdowns and idleness in some plants, where stern necessity has dictated that radical changes must be made in the design or type of equipment which is being manufactured. It is reasonable to expect that if the pace as a whole is speeded up, however, we will reach the established goal, because new plants have come into operation during the first part of the year and further progress will undoubtedly be made in this direction throughout the rest of the year.

On the other hand, industry will suffer heavily from the withdrawal of skilled workers who must enter the services to bring our armed forces to the necessary size. The railroads, seriously as they have been handicapped for needed manpower, must make still further contributions to the building up of the railroad battalions and the other services.

One prominent officer in the Administration has pointed out that up to the first of this year we had spent within 10 per cent as much money for plant construction and equipment as we had for actual production of munitions and fighting equipment. With less materials and manpower required for plant construction and equipment, more will be available for the production of war materials, and we should make more rapid progress.

Our forces have thus far had a few conflicts, which may be likened to the minor bouts required to sharpen up the punch of a heavyweight champion in training for the big fight. When we do get into the real shooting, the piles of war supplies that we have been accumulating will dwindle mighty fast. We must fight desperately hard to make replacements, in order to give the boys at the front the necessary backing. Don't let them kid you into believing otherwise—the stakes are too vital.

Roy V. Wright

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Founded in 1832 as the American Rail-Road Journal

JULY, 1943

Volume 117 *No. 7*

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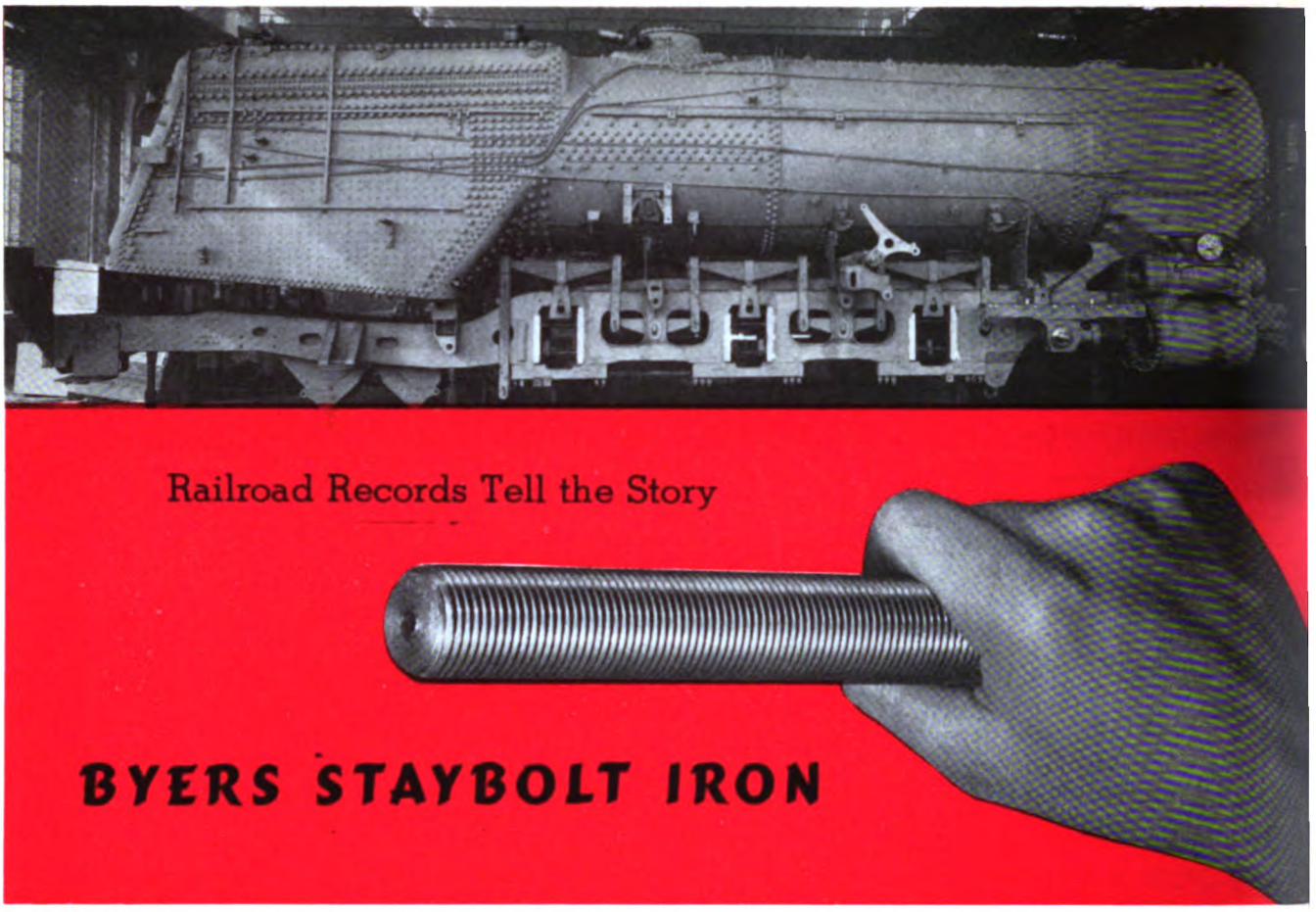
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The best "sales talks" on Byers Staybolt Iron are right in customers' engineering files.

They are written in terms of decreased manufacturing rejects, increased hours and miles between locomotive shoppings . . . like these examples . . .

In one reported case, 339,830 lbs. of Byers Staybolt Iron was formed, drilled, and threaded with only 2401 lbs. of material rejected: ¾%.

In another instance, a superintendent of locomotives made a comparative check of bendability on threaded bolts 8" or 10" long. Byers Staybolt Iron was doubled on itself with no fracture of the outer bend . . . and with no indication that the limit of stretch had even been approached. Failure of the other specimen occurred long before this point was reached.

A locomotive, in for class 3 repairs three years and two months after Byers Staybolts were installed, did not require a single replacement.

Another locomotive was still operating with its original Byers Staybolts after eighteen months . . . although it was reported that some staybolt replacements had been "expected after a year."

Now that it is so essential to get the last possible hour and mile of service out of every locomotive, it may pay you to check your staybolt needs against the high quality, unusual uniformity, and economy of Byers Staybolt Iron.

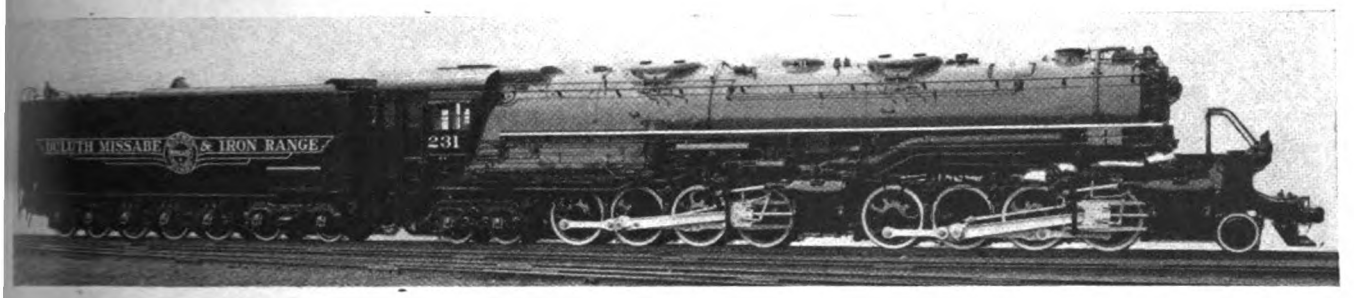
A. M. Byers Company does not manufacture staybolts, but provides material to bolt manufacturers and railroad shops. You can specify it on any of your staybolt orders.

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ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
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D. M. & I. R. Locomotives

Articulated units are designed to haul 6,000-ton trains without the necessity of making fuel or water stops — Tractive force, 140,000 lb.; weight on drivers, 695,000 lb.

THE Duluth, Missabe & Iron Range took delivery, early this year, of 10 single-expansion articulated heavy freight locomotives which rank among the largest built for service in this country. These locomotives have a total weight: (engine and tender) of 1,132,000 lb. and a total wheel base, for the engine and tender, of 113 ft. 4⅜ in. The tractive force is 140,000 lb. and the weight on drivers, 695,000 lb. In an accompanying table there is a comparison of the principal characteristics of this and other large articulated locomotives.

These locomotives, which bear the road numbers 228 to 237, are practically identical in design to an original order of eight, from the plant of the same builder, which were delivered in 1941. These 18 locomotives handle ore trains of 6,000 gross tons from the Vermilion and Mesabi Ranges in Minnesota to the docks at Duluth. The round trip runs require 12 and 10 hours, respectively. The 25,000 gallon tender tanks permit through one-way runs without water stops and the 26 tons of fuel is sufficient for a round trip. On the trip from mines to docks there are numerous adverse grades, the heaviest against load being 0.62 per cent for a distance of three miles. These new locomotives are capable of handling a 25 per cent increase in tonnage as compared with the converted Mallet compound power previously used.

The boiler is the straight-top type, 58 ft. 7½ in. overall length. The barrel is constructed in three courses with sheet thicknesses of $1\frac{5}{32}$ in. and $1\frac{3}{16}$ in. The first course is 104 in. outside diameter. The front and back flue sheets are ¾ in. and ⅝ in., respectively. The circumferential seams are triple riveted while the longitudinal seams are quintuple-riveted butt joints. Carbon-steel sheets are used throughout the barrel and firebox.

The firebox is 210⅛ in. long and 102¼ in. wide with an 84-in. combustion chamber. The firebox and combustion chamber seams are all welded. The crown is designed with slope for 2.2 per cent grades.

There is a full installation of Flannery flexible staybolts in the combustion chamber, throat sheet, breaking zones of the side sheets and in the boundary rows of the back head. Flannery rigid bolts are used in the water spaces.

Four syphons are used in the firebox and combustion chamber; one is located at the forward end of the firebox and one in the combustion chamber on the approximate center line of the boiler, while the remaining two at the rear of the firebox are about 14 in. right and left of the center line. The two rear syphons have their necks in the throat sheet and the other two at the approximate bottom center line of the combustion chamber. There are also two arch tubes and a Gaines wall in the firebox.

The superheater is a 124-unit Type E with American multiple throttle in the header. Five of the locomotives are equipped with Worthington 6½ SA feedwater heaters of 14,400 gal. capacity; the other five are equipped with Elesco K 60 A heaters of 12,000 gal. capacity. All 10 locomotives have Sellers Type SY injectors of 12,000 gal. capacity, located on the left side.

Fuel is fed to the firebox by means of a Standard MB stoker. The grates are the Firebar type and the firedoor is the Franklin 8-A, with a 16-in. by 20-in. opening. The boilers are equipped with the Barco Type F3A low water alarm, Wilson blow-off cocks, mufflers and operating valves.

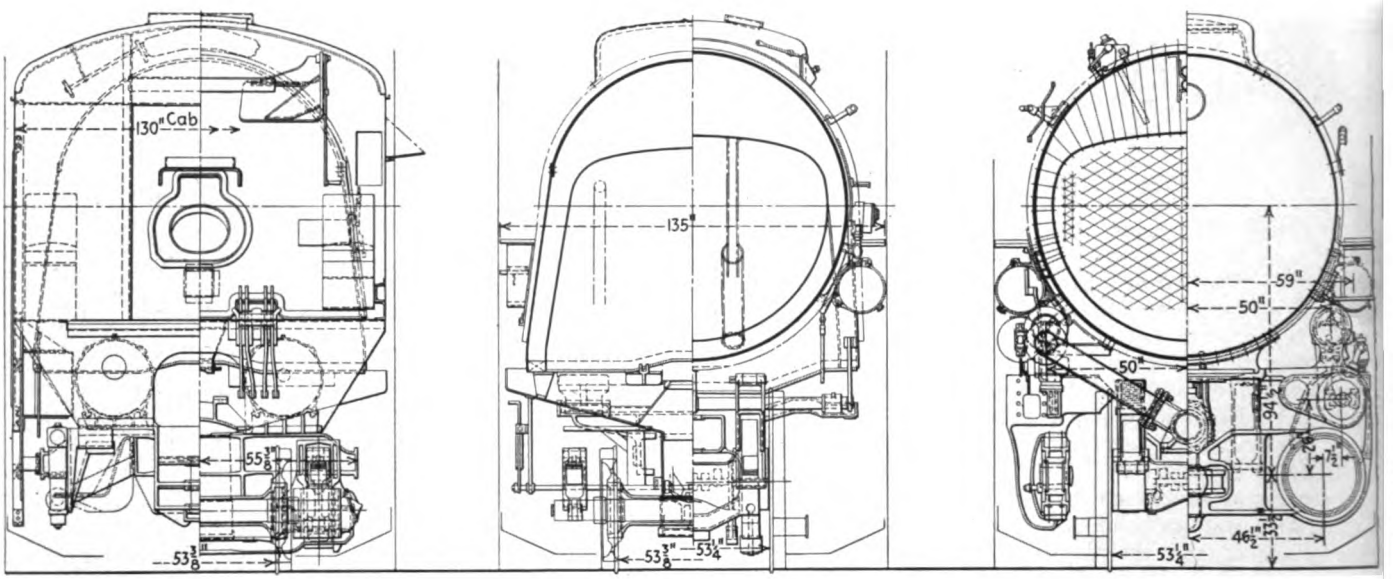
The beds for the front and rear engine units, supplied by the General Steel Castings Corporation, embrace such parts as the cylinders, front bumper, cab support, brake-cylinder brackets, reverse-shaft support, articulation

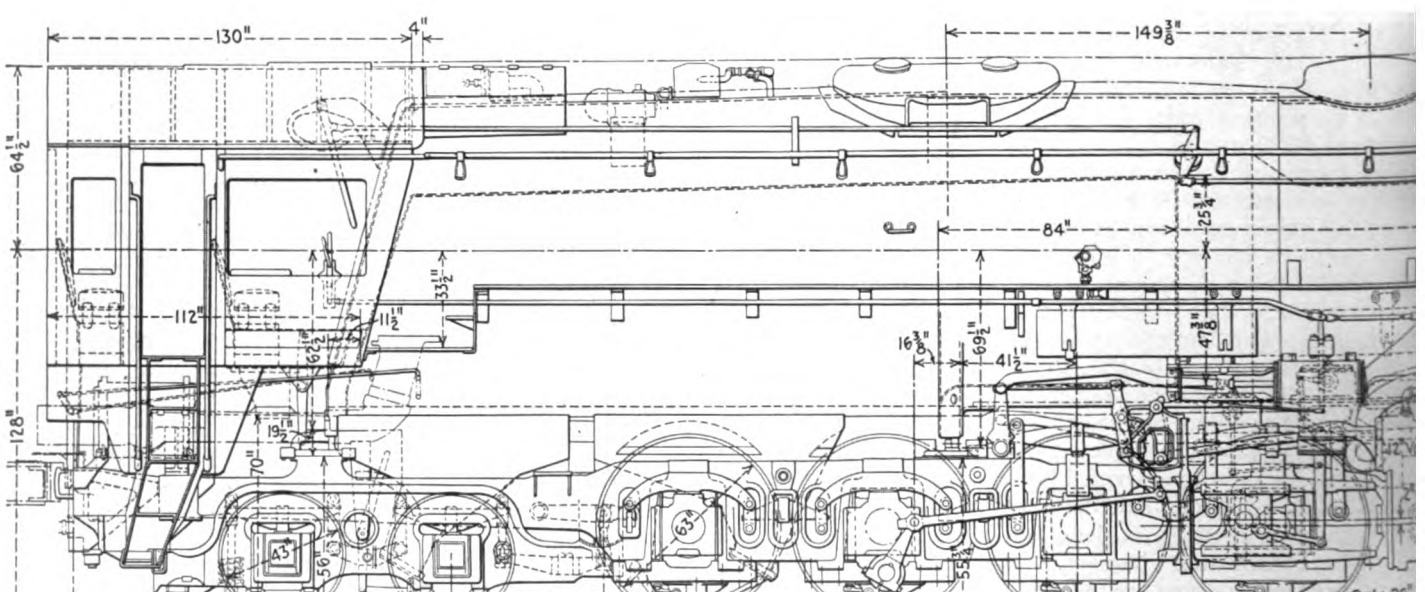
hinge, cradle and trailer rocker plates. The front and rear engine units are connected at the rear cylinders by a conventional articulation hinge. A single boiler bearing of the sliding shoe type, with centering device, is used to transfer the weight of the boiler to the front engine.

The leading engine truck is the General Steel Castings Commonwealth two-wheel type with inside roller bearings. This truck has a swing of 6¼ in. each side of the

Axles, Bearings, Wheel Centers and Tires

	Axles				Wheel Centers			Tires		
Location	Material	Manufacturer	Type Bearings	Journal size, in.	Type	Material	Manufacturer	Diameter in.	Diameter in.	Manufacturer
Front truck....	Carbon steel	Carnegie-Illinois	A.S.F.	.....	Multiple Wear	Wrought steel, heat treated	Carnegie-Illinois	..	36	....
Drivers, main..	Carbon steel	Carnegie-Illinois	Timken	12⅝	Boxpok	Cast steel	Gen. Steel Castings Corp.	56	63	Alco-Ry. Steel Spring Div.
Drivers, other..	Carbon steel	Carnegie-Illinois	Timken	11⅝	Boxpok	Cast steel	Gen. Steel Castings Corp.	56	63	Alco-Ry. Steel Spring Div.
Trailer, front...	Carbon steel	Carnegie-Illinois	A.S.F.	7x14	....	Cast steel	Standard Steel Works	36	43	....
Trailer, rear....	Carbon steel	Carnegie-Illinois	A.S.F.	7x14	....	Cast steel	Standard Steel Works	36	43	....
Tender trucks..	Carbon steel	Carnegie-Illinois	A.S.F.	6½x12	Multiple wear	Wrought steel, heat-treated	Carnegie-Illinois	..	42	....



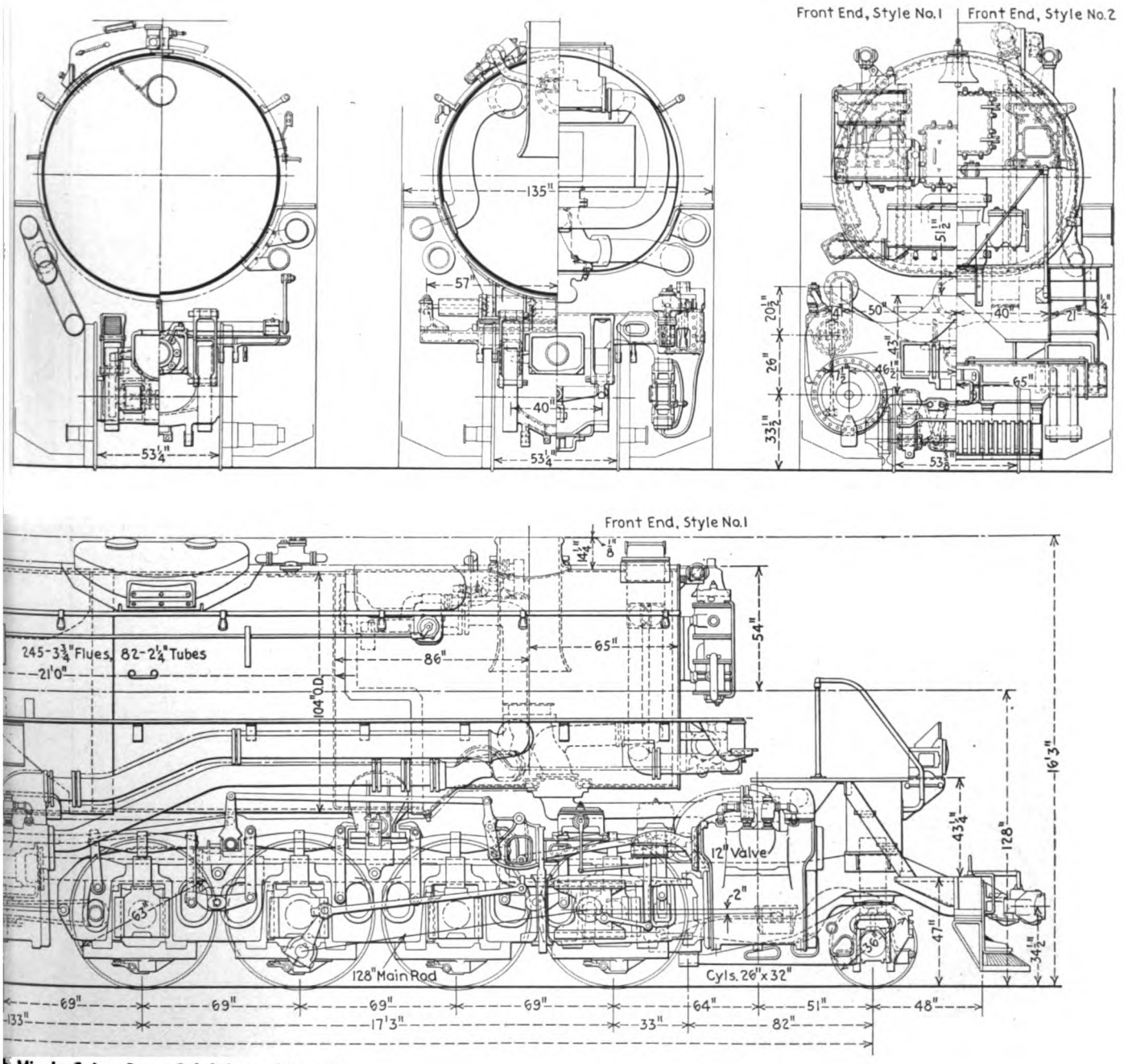


Erecting elevation and cross sections of the

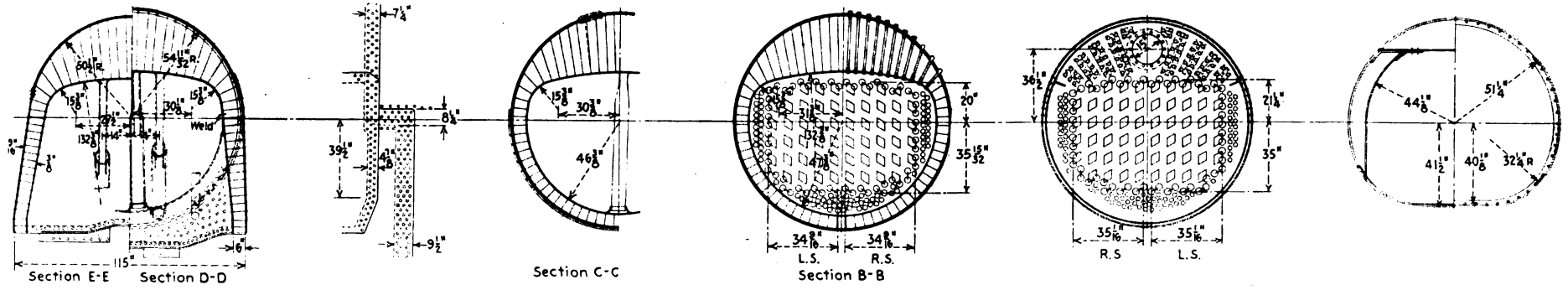
center line. The trailer truck, supplied by the same manufacturer, is the four-wheel type with outside bearings. It is designed to swing 7¾ in. each side of the center line at the rear truck axle. Both leading and trailer trucks have auxiliary bearings; these being of bronze on the leading truck and of cast iron lined with Satco metal on the trailer truck. An accompanying table shows the type, sizes and material of the wheels, tires and axles for both the engine and the tender.

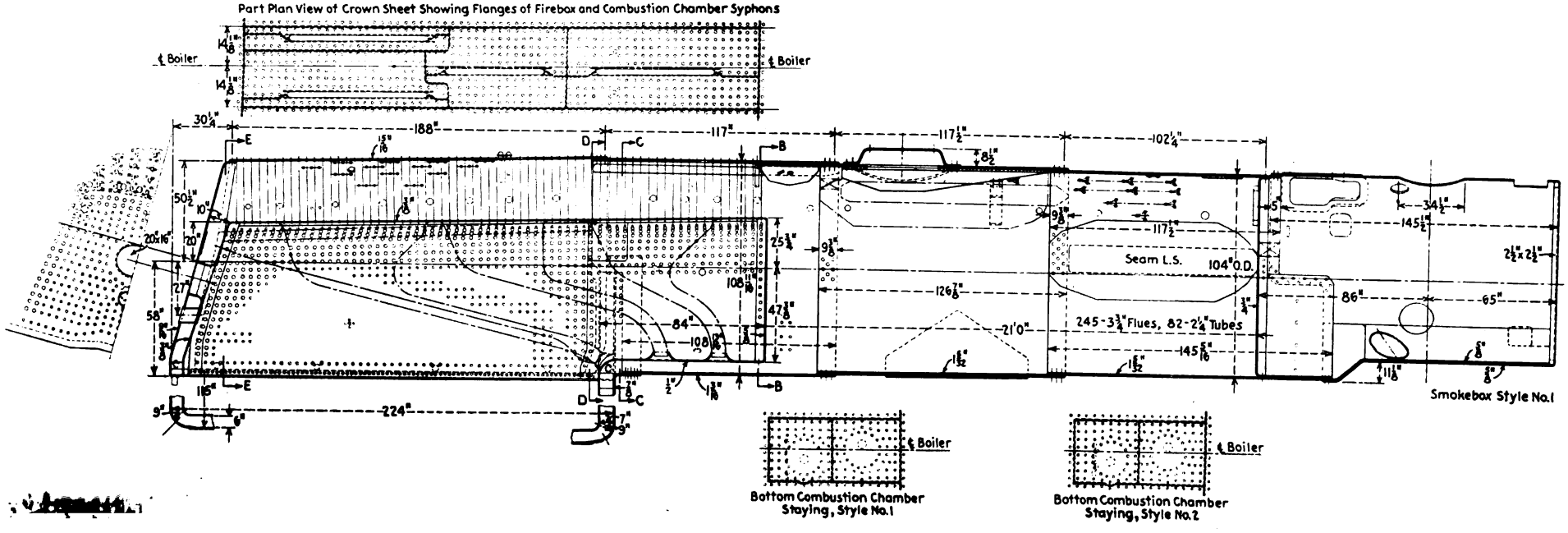
The cylinders, four in number, are 26 in. bore by 32 in. stroke. They have Hunt Spiller bushings—the pistons, piston rings, valves, valve rings and valve-chamber bushings were supplied by the same manufacturer. The valves for both front and rear engines are 12 in. diameter with 8 in. travel on the front engine and 7¾ in. on the rear engine. The Baker valve gear is controlled by a 12-in. Baldwin power reverse gear equipped with Transportation Devices Corporation reverse-gear valve for automatic cut-off control. The crossheads are the alligator type, forged and flame trimmed, with Rogatchoff adjustable wedges and bronze shoes. The wrist pins are hollow-bored carbon steel. The main and side rods are carbon steel. Hollow-bored crank pins are used with floating bushings at the main pins and solid bushings at all other locations. The roller bearing housings for the driving wheel bearings are the split type. The Alco lateral motion device is used at the first, fourth and fifth drivers; 1⅛ in. lateral is used at these locations and ⅜ in. lateral at all other wheels. Franklin automatic compensators and snubbers are used on all drivers.

The weight of the reciprocating parts on one side of each engine unit is 2,382 lb. In the counterbalancing of these locomotives 46 per cent of the reciprocating weights are balanced—2,194 lb. on each side of the locomotive. There is an overbalance of 128 lb. at the main wheels and 323 at all other drivers. The unbalanced reciprocating weights are 3.67 per cent of the total weight of the locomotive in working order.



h, Missabe & Iron Range 2-8-8-4 type locomotive





Longitudinal and cross-sections of the D. M. & I. R. boiler

General Dimensions and Weights of the Duluth, Missabe & Iron Range 2-8-8-4 Locomotives

Builder	Baldwin Locomotive Works
Type of locomotive	2-8-8-4
Road class	M-4
Road numbers	228—237
Date built	March, 1943
Service	Freight
Dimensions:	
Height to top of stack, ft.-in.	16 — 3
Height to center of boiler, ft.-in.	10 — 8
Width overall, ft.-in.	11 — 3
Cylinder centers, in.	93
Weights in working order, lb.:	
On drivers	565,000
On front truck	41,350
On trailing truck	93,350
Total engine	699,700
Tender (fully loaded)	438,300
Total engine and tender	1,138,000
Wheel bases, ft.-in.:	
Driving	45 — 7
Rigid:	
Front unit	5 — 9
Back unit	11 — 6
Engine, total	67 — 2
Engine and tender, total	113 — 4⅜
Wheels, diameter outside tires, in.:	
Driving	63
Front truck	36
Trailing truck	43
General data:	
Rated tractive force, engine 85 per cent, lb.	140,000
Rated tractive force, booster, lb.	None
Speed at 1,000 ft. per min., piston speed, m.p.h.	35.1
Piston speed at 10 m.p.h., ft. per min.	248.5
R.p.m. at 10 m.p.h.	53.3
Engine:	
Cylinders, number, diameter and stroke, in.	4 — 26 x 32
Valve gear, type	Baker
Valves:	
Piston type, diameter, in.	12
Exhaust clearance, in.	Line and line
Maximum travel, front, in.	8
Maximum travel, back, in.	7⅝
Steam lap, in.	1¼
Lead, in.	3/16
Cutoff in full gear, per cent, front	87
Cutoff in full gear, per cent, back	86.3
Boiler:	
Type	Straight top
Steam pressure, lb. per sq. in.	240
Diameter, first ring, inside, in.	101 11/16
Firebox length, in.	210⅛

Boiler, Continued:	
Firebox width, in.	102¼
Height, center line of boiler to crown sheet, back, in.	20
Height, center line of boiler to crown sheet, front, in.	25¾
Combustion chamber length, in.	84
Syphons, number	5
Tubes, number and diameter, in.	82 — 2¼
Flues, number and diameter, in.	245 — 3¾
Length over tube sheets, ft.-in.	21 — 0
Net gas area through tubes and flues, sq. in.	1,997.6
Fuel	Bituminous coal
Grate area, sq. ft.	125
Heating surfaces, sq. ft.:	
Firebox	379
Combustion chamber	177
Arch tubes	32
Syphons	138
Firebox, total	726
Tubes	1,009
Flues	5,023
Evaporative, total	6,758
Superheating	2,770
Combined evap. and superheat.	9,528
Boiler proportions: (estimated)	
Firebox heat. surface, per cent comb. heat. surface	7.6
Tube-flue heat. surface, per cent comb. heat. surface	63.3
Superheater heating surface, per cent comb. heat. surface	29.1
Firebox heat. surface ÷ grate area	5.81
Tube-flue heat. surface ÷ grate area	48.26
Superheater heat. surface ÷ grate area	22.2
Comb. heat. surface ÷ grate area	76.2
Gas area, tubes-flues ÷ grate area	0.11
Evaporative heat. surface ÷ grate area	54.1
Tractive force ÷ grate area	1,120.0
Tractive force ÷ evap. heat. surface	20.7
Tractive force ÷ comb. heat. surface	14.69
Tractive force × diameter drivers ÷ comb. heat. surface	925.7
Weight proportions: (estimated)	
Weight on drivers ÷ weight engine, per cent	80.7
Weight on drivers ÷ tractive force	4.04
Weight of engine ÷ evaporation	103.5
Weight of engine ÷ comb. heat. surface	73.4
Tender:	
Style	Rectangular
Water capacity, U. S. gal.	25,000
Fuel capacity, tons	26
Wheel diameter, in.	42

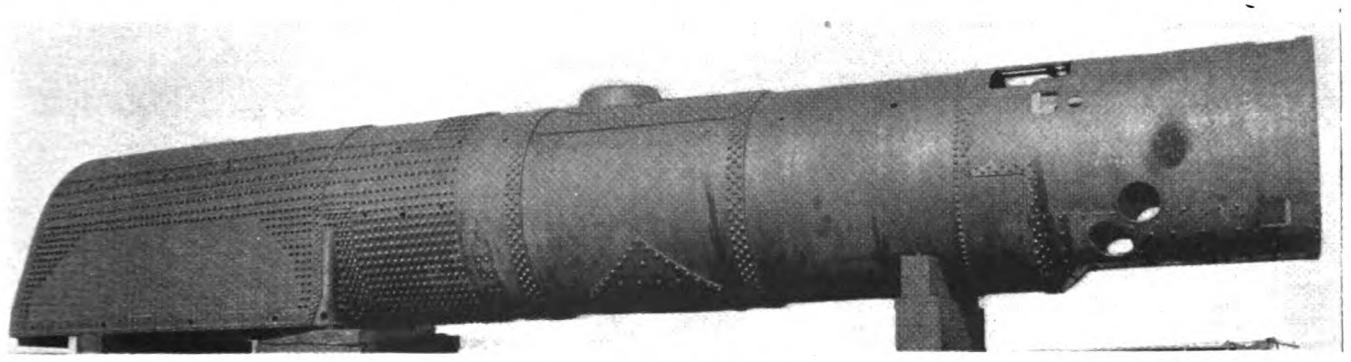
The spring rigging of these locomotives is of conventional design. On the front engine the spring rigging is continuous from the engine truck to the intermediate driver and is cross equalized. The main and rear drivers are equalized together on each side of the locomotive. On the rear engine the suspension is continuous on each side of the locomotive from the front driver to the rear trailer wheel. Coil buffer springs are used in the anchor hangers at the rear of the trailer truck. Case-hardened and ground bushings are used throughout the spring rigging; Fabreeka pads are used under the spring ends.

Mechanical lubricators, four in number, with 36 feeds are located on the front and rear units. The parts lubricated by oil under pressure are: cylinders, valves, stoker, guides, valve-stem guides, feedwater pump, frame and truck pedestals, steam- and exhaust-pipe joints, compensators, hinge pins, furnace bearers and sliding plates. Grease lubrication with Alemite fittings is used for such parts as crosshead pins, eccentric rods, reverse-lever guides, engine-truck center plate, side-rod knuckle pins, throttle rigging, valve-rod crossheads, lubricator rigging, crank pins, cushioning device, drawbar pins and tender vestibule.

The cab is the vestibule type of welded construction, completely insulated and weatherstripped. It is unusually roomy, being 130 in. wide and 112 in. long, at the deck. There are two seats on each side.

The locomotive brake equipment is Westinghouse No. 8ET with two 8½-in. cross-compound compressors located on brackets at the front of the smokebox. Four Wilson grid radiation elements are used for cooling. The driver brake is operated by 12-in. by 10-in. cylinders and has a braking ratio of 50 per cent at 50 lb. cylinder pressure.

Other equipment used on the locomotives includes TZ cylinder cocks and operating valves, Viloco cylinder by-pass valves, Locomotive Valve Pilot, A. S. F. type

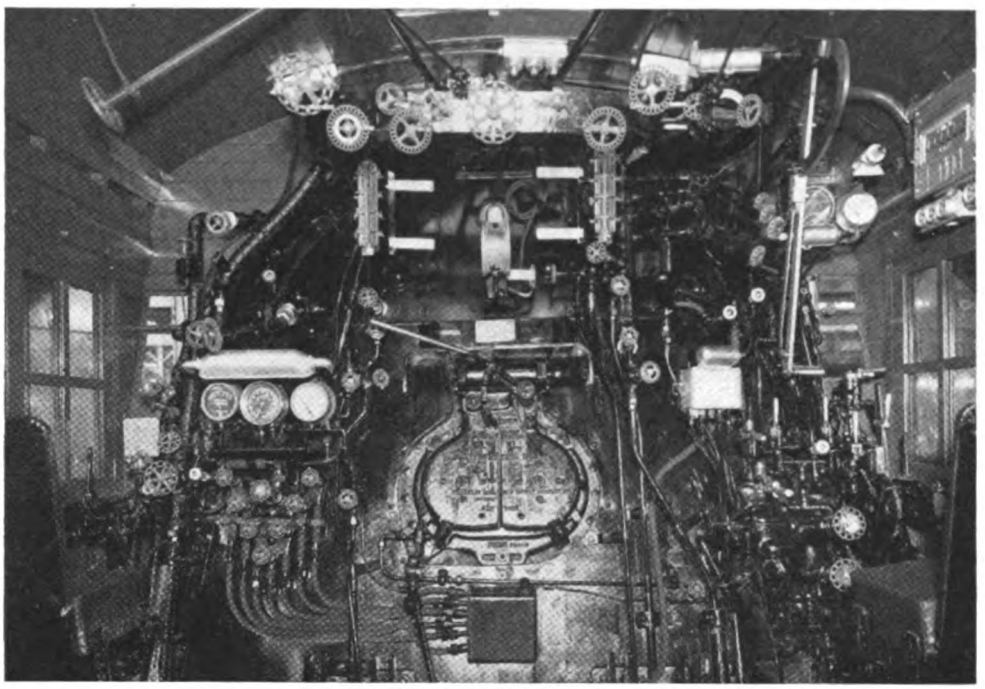


Exterior of one of the boilers

Comparative Characteristics of Large Six- and Eight-Coupled Locomotives

	D.M.I. & R. 2-8-8-4	Northern Pacific 2-8-8-4	West. Pac. 2-8-8-2	Union Pac. 4-8-8-4	Nor. & West. 2-6-6-4	C. & O. 2-6-6-6
Road class	M-4	Z5	M137-151	.....	A	H 8
Road numbers	228-237	5000	251-260	4000-4019	1200-1224	1600-1609
Builder	Baldwin	Alco	Baldwin	Alco	Co. shops	Lima
Date built	1943	1928	1937	1941	1936,'37,'43	1941
Service	Freight	Freight	Freight	Freight	Pass. & Frt.	Freight
Weight on driver, lb.*	565,000	554,000	549,656	540,000	432,350	471,000
Total engine, lb.*	699,700	715,000	663,100	762,000	573,000	724,500
Tender, lb.*	438,300	41,000	403,350	435,800	378,600	426,100
Cylinder, diameter and stroke in.	(4) 26x32	(4) 26x32	(4) 26x32	(4) 23¾x32	(4) 24x30	(4) 22½x33
Diameter, driving wheels, in.	63	63	63	68	70	67
Steam pressure, lb.	240	250	235	300	300	260
Fuel	Bituminous	Sub-bituminous	Oil	Bituminous	Bituminous	Bituminous
Grate area, sq. ft.	125	182.0	145.0	150.3	122	135.2
Firebox heat. surf., total sq. ft.	726	610	670	704	530	600
Evap. heat. surf., sq. ft.	6,758	7,673	6,811	5,889	6,639	7,240
Super. surf., sq. ft.	2,770	3,219	2,152	2,466	2,703	3,186
Tractive force, engine, lb.	140,000	139,900	137,000	135,375	114,000	110,200
Tractive force, booster, lb.	None	13,400	None	None	None	None
Fuel capacity, tons	26	27	6,000	28	26	25
Water capacity, gal.	25,000	21,200	22,000	25,000	22,000	25,000

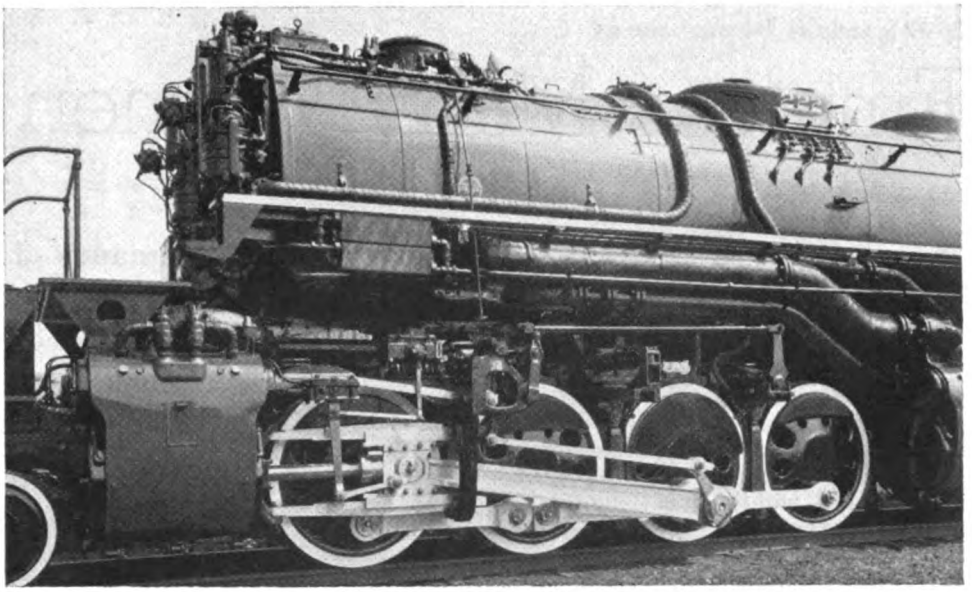
* Weights in working order.



The cab is unusually large and the arrangement of controls and gauges on the backhead is convenient for the engine crew

Partial List of Material and Equipment on the Duluth, Missabe & Iron Range 2-8-8-4 Locomotives

Locomotive bed; engine and trailer-truck frame	General Steel Castings Corp., Eddystone, Pa.
Boiler and firebox steel; front bumper plate; tank plates	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Grates	Waugh Equipment Co., New York
Fire brick	American Arch Co., Inc., New York
Washout plugs; boiler plugs; sandbox plugs	Huron Mfg. Co., Detroit, Mich.
Crown drop plugs	Nathan Manufacturing Co., New York
Boiler lagging; smokebox door gaskets; cylinder lagging	Johns-Manville Sales Corp., New York
Flue blower	Superior Railway Products Corp., Pittsburgh, Pa.
Staybolt iron	Ewald Iron Co., Louisville, Ky. Lockhart Iron & Steel Co., McKees Rocks, Pa. Ulster Iron Works, Dover, N. J.
Flexible staybolts	Flannery Bolt Co., Bridgeville, Pa.
Syphons	Locomotive Firebox Co., Chicago
Front-end throttle	American Throttle Co., New York
Throttle-valve-stem packing	The Garlock Packing Company, Palmyra, New York
Dry pipe; boiler tubes and flues; arch tubes	National Tube Co., Pittsburgh, Pa.
Superheater; pyrometer	The Superheater Company, New York
Injectors; injector steam valve; coal sprinkler	Wm. Sellers & Co., Inc., Philadelphia, Pa.
Injector check valve	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division of, Bridgeport, Conn.
Low-water alarm; flexible joint in blow-off cock piping; drain valve; lubricator steam-heat joint	Barco Manufacturing Co., Chicago
Feedwater heater	(5) The Superheater Company, New York (5) Worthington Pump and Machinery Company, Harrison, N. J.
Stoker; coal pusher	Standard Stoker Co., Inc., New York
Blow-off cocks and mufflers; operating valves; radiator elements; air compressors	Wilson Engineering Corp., Chicago
Safety valves	Coale Muffler & Safety Valve Co., Baltimore, Md.
Water gage	Talmadge Mfg. Co., Cleveland, Ohio
Gage cocks; inspection card holders	The Prime Manufacturing Co., Milwaukee, Wis.
Bell ringer	Railway Service & Supply Corp., Indianapolis, Ind.
Gages—air, back pressure and steam	Ashton Valve Co., Boston, Mass.
Gage holders	The Swanson Company, Chicago
Steam pipe joint packing; exhaust pipe joint packing	The Garlock Packing Company, Palmyra, New York
Whistle; operating valve and check; rail washer	Viloco Railway Equipment Co., Chicago
Runboards; grating and runboard steps; front deck and cab deck	Irving Iron Works Co., Long Island City, New York
Waist sheet bearer pad; boiler support pad; spring end pads; back trailer hanger pads	Fabreeka Products Co., Boston, Mass
Draft gear; draft gear yokes—engine and tender	W. H. Miner, Inc., Chicago
Coupler; pilot; pilot coupler pocket; driving springs; engine truck springs; trailer springs	American Steel Foundries, Chicago



The arrangement of the front end showing the mounting of the air compressors, the mechanical lubricators and the arrangement of motion work

Cylinder bushings; piston valve bushings; pistons; piston valves; cylinder packing rings and piston valve packing rings	Hunt-Spiller Manufacturing Corporation, Boston, Mass.
Cylinder-by-pass valves	Viloco Railway Equipment Co., Chicago
Cylinder cocks and operating valves	T-Z Railway Equipment Co., Chicago
Roller bearings, driving	The Timken Roller Bearing Co., Canton, Ohio
Roller bearings—engine and trailer; clasp brakes	American Steel Foundries, Chicago
Axles, engine-truck wheels	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Tires, driving and trailing	American Locomotive Co., Railway Steel Spring Div., New York
Trailer wheels	Standard Steel Works Division of the Baldwin Locomotive Works, Eddystone, Pa.
Driving wheel centers	General Steel Castings Corp., Eddystone, Pa.
Brake shoes	American Brake Shoe Company, New York
Foundation brake	American Brake Div., Westinghouse Air Brake Co., Wilmerding, Pa.
Brake equipment	Westinghouse Air Brake Co., Wilmerding, Pa.
Crossheads; wrist pins; guides	Standard Steel Works Division of the Baldwin Locomotive Works, Eddystone, Pa.
Crosshead shoes; eccentric rod brasses; main and side rod bushings	National Bearing Metals Corp., St. Louis, Mo.
Piston-rod and valve-stem packing	Paxton-Mitchell Co., Omaha, Neb.
Valve gear	Pilliod Co., New York
Reverse gear	Baldwin Locomotive Works, Inc., Philadelphia, Pa.
Reverse-gear packing	Johns-Manville Sales Corp., New York
Reverse-gear valve	Railway Service & Supply Corp., Indianapolis, Ind.
Lubricator oil pipe covering; lubricator steam pipe covering; steam pipe covering	Union Asbestos & Rubber Co., Chicago
Air-compressor lubricator	U. S. Metallic Packing Co., Philadelphia, Pa.
Firedoor; radial buffer; automatic compensator and snubber; bronze floating plates on all driving boxes	Franklin Railway Supply Co., Inc., New York
Mechanical lubricators; lubricator distributors; oil and terminal checks; flange oiler; lubricator tube fittings	Nathan Manufacturing Co., New York
Lubricator tubing (steel)	Bundy Tubing Co., Detroit, Mich.
Grease fittings	Alemite Div., Stewart-Warner Corp., Chicago
Locomotive valves	Crane Co., Chicago
Marker lamps	The Adams & Westlake Co., Elkhart, Ind.
Headlights and generator	The Pyle-National Company, Chicago
Sanders; traps; operating valves	Graham-White Sander Corp., Roanoke, Va.
Valve Pilot; speed recorder	Valve Pilot Corporation, New York
Air-pump lubricator checks	Bonney Forge & Tool Works, Allentown, Pa.
Cab apron	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Cab seats	Gustin-Bacon Mfg. Co., Kansas City, Mo.
Cab-door weatherstripping	Bridgeport Fabrics, Inc., Bridgeport, Conn.
Cab insulation	Johns-Manville Sales Corp., New York
Cab ventilator; windshields; clear vision windows; curtains	The Prime Manufacturing Co., Milwaukee, Wis.
Cab lamps	The Pyle-National Company, Chicago
Tender:	
Frame; trucks	General Steel Castings Corp., Eddystone, Pa.
Wheels and axles	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Coupler; springs	American Steel Foundries, Chicago
Journal bearings	American Steel Foundries, Chicago Magnus Metal Corporation, New York
Brake shoes	American Brake Shoe Company, New York
Trailer box lids; truck boxes; truck-box lids	National Malleable & Steel Castings Co., Cleveland, Ohio
Truck box pads	Fabreeka Products Co., Boston, Mass.
Safety bars and drawbar	Standard Steel Works Division of the Baldwin Locomotive Works, Eddystone, Pa.
Tank hose	United States Rubber Co., New York
Tank valves; drain plugs; couplers and strainers; hose couplings	T-Z Railway Equipment Co., Chicago
Tank water level indicator	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Sleeve joints between engine and tender	Franklin Railway Supply Co., Inc., New York

E 6-in. by 8-in. couplers with Simplex pockets, Miner A-78-XB draft gear, Franklin E-2 radial buffer, Pyle-National headlight and cab lamps, and Graham-White sanders, traps and operating valves.

The Tender

The tenders are the rectangular-U type with a fuel and water capacity of 26 tons and 25,000 gal. The underframe and trucks were supplied by the General Steel Castings Corporation. The tender* is carried at the front by a four-wheel truck back of which are five pairs of wheels mounted in pedestals cast integral with the bed. The 42-in. tender wheels operate in A. S. F. roller-bearing assemblies with auxiliary bearings.

The coal space is equipped with a Standard type DA coal pusher. Franklin flexible joints are used on the air-brake lines, and stoker and coal-pusher steam lines between engine and tender.

The tender draft gear is Miner A-78-XB and the couplers are A. S. F. Type E.

The tender trucks are equipped with A. S. F. clasp brakes designed for operation on 18-deg. curves, operated by 8-in. by 10-in. cylinders and having a braking ratio of 70 per cent at 50-lb. cylinder pressure.

* For a description of this type of tender frame see the *Railway Mechanical Engineer* for October, 1940, page 386.

Employs Many Women Workers

Demands of the armed services and competition of war industries force railroads to go to unusual lengths in the effort to solve the manpower problem

(*Illustrations on pages 327, 333 and 340*)

A ROUGH survey of the mechanical department manpower situation indicates that while some railroads have gone to unusual lengths in recruiting women workers to replace men who have gone into the armed services, or who have been attracted to the war industries, other important railroads have added few, if any, women to their forces, except perhaps in those limited occupations in which women were employed in normal times.

It is not surprising to find that systems like the Pennsylvania, in a highly industrialized area, or the Southern Pacific, serving the West Coast region, in which great war industries have sprung up almost overnight, have introduced an unusually large number of women into jobs not normally performed by them. It is just as surprising, however, to find some systems serving industrial or agricultural sections that have added few, if any, women to their forces, except to replace men in clerical positions, which were normally open to women as well.

Before the entry of this country into the war, the Pennsylvania System employed only about 1,300 women. Today the number is in the neighborhood of 20,000. Approximately 1,500 of these are helpers to blacksmiths, boilermakers, carmen, electricians, machinists, tinsmiths, tender repairmen, upholsterers and cranemen. Two women operate hammers in the blacksmith shop; there are 20 women boiler washers; more than 300 women oilers, and about 700 women locomotive cleaners and preparers. There are now more than 2,000 women coach cleaners, of whom a number have become gang foremen.

As of May 5, the mechanical department of the Illinois Central employed 758 women. Of these, 231 were in the locomotive department. In addition to 43 clerks, there were 6 electrical helpers, 2 machinist helpers, 2 engine washers, 13 water testers and 165 laborers. Of the 527 women employees in the car department, only 15 were clerks; the others included 3 upholsterers, 10 carman helpers, 1 wheel roller, 199 cleaners, 13 car oilers, 4 caboose supply, and 38 laborers.

As of June 1, about 12,060 employees of the Southern Pacific had been called into service. As of that date, approximately 3,000 women were employed in the motive power and car departments, stores department and maintenance of way department. Recognizing that the introduction of a large number of women into departments in which previously only men had been employed, and at jobs which in many instances required heavy physical effort, involved unusual and highly specialized problems if the most efficient results were to be secured, the Southern Pacific mechanical department appointed a supervisor of women employees in each of its two districts, North and South.

"New Grooms For the Iron Horse"

The Pacific Railway Club, always keen to keep its programs abreast of the times, announced as the subject of its May meeting, "New Grooms for the Iron Horse." The speakers were Mrs. M. J. Warren, supervisor of women employees, mechanical department, Southern Pacific Company, Northern District; and Mrs. R. L. Tibbett, supervisor of women employees, mechanical department, Southern Pacific Company, Southern District. They must have made a distinct impression upon the club members, since its board of governors decided thereafter to admit women to membership in the club on the same qualifications as men. This was "because of the splendid showing that women are making in the war effort, particularly in supervisory positions."

Extracts from the talks given by Mrs. Warren and Mrs. Tibbett follow:

Women Workers on Southern Pacific

*By Marjorie J. Warren**

Every day we hear of the WAACS, the WAVES and the SPARS, who have a place on the front pages of our newspapers, and who are without doubt playing a great part in the United Nations' war effort, relieving men for active duty at the front. Unsung and unheralded is that noble group of women who are taking the places of men on our transportation systems today, so these men may fill the ranks of our fighting units.

Women have long been employed in some industries and their places there are taken for granted; their work has been satisfactory in every way. In the railroad industry it was different. Some departments were considered as man's domain and women were not welcomed; in fact, were denied the privilege of proving their ability to do the work involved. As men became scarcer, the women were given a chance at some of the heavier work and on some of the machines.

In our railroad shops the placing of women has been gradual. First as laborers, to helpers, and so on to other work. Now there is a demand for women and we are encouraging women to study and fit themselves for the various branches of railroad shop work; to fit themselves for advanced work and to be ready to step in when the opportunity affords.

Personality Problems

In placing women in railroad work, there are a number of personality qualities to consider, which cannot be

* Mrs. Marjorie Jane Warren, a former school teacher and practical nurse, gave up her nursing practice in September, 1942, to become a laborer in the Sacramento, Calif., shops of the Southern Pacific. A month later she was made toolroom attendant in the pipe shop and was given the title of pipefitter's helper. On January 16, 1943, she was promoted to the newly created position of supervisor of women.

overlooked. They have to be dealt with and this must be done with tact and understanding. I shall list and deal with these as follows:

1. As women are inclined to be more sociable than men, and as this trait is more pronounced in some women than in others, we must look for some visiting between employees during working hours, and deal with the problem in a nice way. Otherwise we would create a bad feeling which must be avoided.

2. Again, women are inclined to be less aggressive than men and this is only natural. In her long years of keeping up her home, rearing her children and caring for her husband's comfort and welfare, woman, in the security of her home, has had no reason to put herself forward in an aggressive manner.

3. Women are inclined to be more sensitive to criticism than men, and this is a hard problem to deal with. Her nervous system being so vastly different from man, it is but natural that she is more sensitive to any criticism of her work, no matter how trivial. They strive to do their work well and are eager to learn, and if criticized they take it to heart.

4. Women are inclined to take things that happen in their work quite personally, and this becomes a problem to deal with, but we are doing a nice job of overcoming this.

5. Women are more sensitive to discomforts than most men. Women have always strived to be comfortable no matter what their surroundings, and we have but to look into their homes to note the many little comforts they provide, so it is natural that such things as dust, dirt and drafts are irritating. As they become more accustomed to their work and surroundings, these irritating discomforts will be less noticed.

6. Women are inclined to be more interested in the activities and conduct of others. In other words, they take more notice and interest in those that work with them, so—

7. We find that pleasant associations with other workers are an important factor in inducing the women to like their work.

8. More petty quarrels and disputes occur among women than among men, and we find that some women feel they have occasion to feel slighted if they are of the opinion that some other woman is given a little better place, and they want to dispute her right to that place. This is taken care of nicely if one uses a little tact in settling the disputes.

A desire for praise is very strong among women, and a little word here, a pat on the back there, and a smile to go with it, will do a world of good and accomplish a great deal.

Positions Filled By Women

Among the many and varied positions now being filled by our women employees I might list the following:

Running drill presses, bolt and nut threaders, operating steam hammers, stationary firewomen, fire lighters, blacksmith helpers, cleaning and servicing batteries, assisting painters, machinist helpers, oiling and packing journal boxes on freight cars, delivery clerks on trucks, sorting and assembling material, making boxes, babbitting journal bearings, removing babbitt from worn-out bearings, running broaching machines on car bearings, sorting scrap, etc. They have now been assigned as helpers to nearly every craft in the shops, and in the stores department have taken over all but the very heaviest work.

Women Workers in Southern District

*By Ruth L. Tibbet**

A few years ago it would have been practically impossible for us to visualize a woman with her gay bandanna, or jaunty cap, attractive make-up and overalls, busily operating a steam hammer, running a crane, a drill press, or a bolt machine. My southern district includes Bayshore and San Francisco, south to Yuma. I have approximately 1,700 women, about 550 of whom are in the Los Angeles area, 250 at Bayshore, with women in San Francisco, San Luis Obispo, Bakersfield, Mojave, Colton and Indio.

In addition to the work mentioned, we have a large number of laborers who keep our shops and grounds clean; also helpers in machine, paint, electric, pipe, boiler, blacksmith and car shops. According to a recent memorandum of agreement, it is possible for a helper with 60 days seniority to bid on a helper apprenticeship. Some of our women are very interested in doing this.

Besides shop work, we have the all-important job of keeping our engines serviced. We use girls in the roundhouse as oilers, grease cup fillers, supply women, cellar packers, fire lighters and watchers. Girls also keep the roundhouse clean, wash engines and clean the cabs.

In the coach yard the girls clean all of our cars inside and out, and despite the speed with which they come and go, the women keep them cleaner than they have ever been before.

The general foremen in our shop have charge of placing the women in the department where they are most needed. The women bid on helpers' jobs the same as men. However, we have encouraged the practice of setting up laborers to helpers according to their length of service with the company. We have women of all ages from 18 to 60, and all types and all nationalities.

Company's Obligations To Women

I have told you in a general way what women are doing for us. Now—what are we doing for women? We have, first, endeavored to make our work as interesting and profitable to women as possible. We have made our rest rooms comfortable and complete by providing dressing and locker rooms, lunch room and showers. In my capacity as counselor, I have obtained information for our women concerning housing, day nursery care, a list of available afternoon playgrounds, family problem clinics and health clinics.

We are encouraging our girls to take advantage of the helper apprenticeships and are encouraging them to study. We are carrying on a survey in our shops to see in how many jobs in each department we can use women. A program is under way to acquaint supervisors with the necessity of bringing women into our shops. We are helping them to study the problems arising from the employment of women, such as their differences in temperament, their sensitiveness to favoritism, and their slower grasp of mechanics. With proper planning, women can be used in every department of the railroad. The manpower shortage is so acute that our women employees are becoming doubly valuable. We have safety men and

(*Continued on page 312*)

* Mrs. Ruth L. Tibbet comes of a railroad family. Her father is J. E. Lingenfelter, a draftsman at the Los Angeles shops, who was at one time supervisor of apprentices at El Paso. Mrs. Tibbet is a former professional accompanist in radio and concert work, practical nurse, drama coach and public school teacher. She entered the service of the Southern Pacific in July, 1942, as a general clerk in the office of the superintendent of motive power at Los Angeles, and was working as a timekeeper when promoted to her present position on February 1 of this year.

Steam Distribution*

Part II

By Walter Smith†

Characteristics of piston valves and conventional valve gears—Their strong points and shortcomings and how best results may be obtained with them

Difficulty of Obtaining Effective Steam Distribution

AUTHORITIES agree that an ideal valve and valve-gear arrangement would give (a) infinite variability of cut-off, (b) full valve opening at all cut-offs, (c) rapid opening and closing of the valves, and (d) control of the timing of admission, release, and compression, independent of the cut-off. The piston valve and our present radial valve gears fall short of these requisites. Obviously, the principal shortcomings of the present arrangements are the fixed relationships between the valve events, and, most important of all, the difficulty of obtaining suitable steam port openings at short cut-offs. The fact deserves notice in this connection that one of the inherent characteristics of our present radial valve gears is that the short cut-off port opening is only the lead plus a small increment depending upon the ratio of lap and lead to valve travel. A moment's consideration will show that this is sure to restrict the steam volume passed by the valves at high speed. It is not easy to visualize the rapidity with which the valve events take place at high speed.

For example, at diameter speed—336 revolutions per minute—the interval of time for admission at 25 per cent cut-off is approximately one-fortieth of a second.

Considering the fact that the port opening is small and the time interval for admission short, it is not surprising that the steam pressure drops rapidly between the point of admission and cut-off. Wire drawing is concerned here also. As the piston moves away from the cylinder head the flow of steam is not sufficient to keep up with the increasing volume of cylinder and what is known as initial expansion is present from the beginning of the stroke.

Obtaining More Effective Steam Distribution

The object desired is to secure ratios and proportions that will give more adequate port areas, and thus insure a higher mean effective pressure at high speed. Steam-port opening areas at any particular cut-off can only be increased by (1) increasing the diameter of the valve, (2) widening the steam lap, and (3) increasing the lead. In view of the fact that it is impracticable to use valves larger than 14 in., and lead in excess of $\frac{5}{16}$ in., it appears that the only alternative is to extend the steam lap. These facts are recognized, and the trend is toward consideration of wider steam lap. Here it may be of interest to point out the main facts concerning this important detail.

Extended Steam Lap

Theoretically, there is considerable to be gained by widening out the steam lap. In most every respect the advantages are outstanding. When the lap is extended, the following desirable features are obtained:

1—Wider port openings for both admission and exhaust, particularly in shorter cut-offs.

2—Increased valve travel for a given point of cut-off, resulting in greater valve velocity and quicker full port opening with a longer duration of the maximum port opening.

3—More accurate timing of valve events, and steam volumes to and from the cylinder more positively governed.

4—Decreased influence from lost motion and faulty adjustments of valve gear.

5—Less pre-admission for a given lead at all points of cut-off.

6—Full and free pre-release, resulting in a lower back pressure.

7—Better control of compression.

8—Higher mean effective pressure at all points of cut-off.

Offsetting these advantages to a slight extent is the fact that the increase in lap shortens the full-gear cut-off, unless provision is made for longer valve travel.

Let us consider now a less effective means of getting more adequate port openings.

Piston Valves of Liberal Diameter

Although it is possible to get considerably greater port opening areas by increasing the diameter of piston valves, it seems to be generally conceded that valves of 14 in. or 15 in. in diameter are to be considered the maximum desirable from a construction and operating standpoint. Within these limits, the larger the valve the more effective the steam distribution in consequence of the reduced throttling or wire-drawing effect. But with the larger valves it is necessary to accept greater weight, increased clearance volume, and greater frictional and inertia forces. It has been determined by experiment that the stresses in valve rods and valve gear increase with the speed, cut-off, and weight of valves. Granting that there is some gain in inertia effect by use of a smaller valve, the fact remains that this is offset to a large extent by the longer cut-off and greater valve displacement required for the same power output.

No one will question the desirability of using the

* A paper presented before the Northwest Locomotive Association at St. Paul, Minn., on April 19, 1943. Part I appeared in the June issue.

† Western manager, Pilliod Company.

smallest and lightest valves consistent with other considerations. However, it must be borne in mind that restricted valve openings distinctly and definitely limit the horsepower capacity of high-speed locomotives. Consequently, there is good reason for questioning the wisdom of reducing valve sizes below those now considered permissible. In spite of all the arguments that can be offered in justification of smaller valves, there are very compelling reasons for using valves of liberal diameter. It is manifestly impossible to develop high cylinder horsepower on a fine thread of steam, and that is what happens when a small-valve locomotive is operated at short cut-offs. It has been aptly stated that the most noticeable characteristic of small-valve locomotives is the longer cut-off required, and the higher back pressure developed for a given power output.

Obviously, the logical thing to do is to take full advantage of weight-saving construction in valves of liberal diameter, and then provide a valve gear to meet the stresses. There is evidence to indicate that the vogue for small piston valves is passing. Lastly, it should be pointed out that it is vitally necessary that the area of the cylinder port should be sufficient to take care at the end of the stroke of the exhaust-opening area provided by the valve. Otherwise, it is ineffectual to provide valves of liberal diameter.

Distribution Valves

Advantages and Disadvantages of Piston Valves

The piston valve is peculiarly adapted to modern locomotive service. It has served the need of a dependable device for distributing steam to locomotive cylinders for forty years; and there is nothing at present to indicate that it will be superseded. The fact that it does not require precision workmanship and that it is dependable to an unusual degree have made it almost an indispensable part of modern locomotive design. That it has shortcomings no one will deny. Principal among these are frictional resistance from sliding surfaces, inability to relieve excess pressure in the cylinder port, imperfect ring balance, the fixed relationship between the valve events, and inertia effect from unbalanced weight.

Design of Piston Valves

In the design of piston valves weight is of primary importance. Until recently full advantage was not taken of the possibilities for weight saving. A not inconsiderable saving in weight may be effected by welding flanged ends to a pipe for spool construction. An area through the spool equal to about half the area of exhaust nozzle orifice is sufficient to obviate the hammering of the exhaust steam on the valve ends. Hence a spool constructed of 6-in. pipe or tubing will suffice in most cases. Preferably, the flanged ends of spool should have an angle of 45 deg. instead of 90 deg. There is a possibility that the latter will distort when the valve is tightened up. When advantage is taken of the full possibilities of reducing the weight of spool, bull-rings, and followers, the weight of valve stem can also be reduced, and to insure a high safety factor the improved physical properties of alloy steel can be utilized for strength and weight saving.

Piston-Valve Details

It has been proposed to modify the design of packing rings. The object in view is to improve packing rings by locking and putting them in perfect steam balance, preventing exhaust rings from collapsing under compression, or being forced from grooves into ports between bridges, and stopping leakage of live steam to the exhaust side of the valve. These are attractive advantages but very difficult of accomplishment. It appears that the laws governing the pressure balancing of rings are imperfectly understood, and efforts made in the past to improve this feature were not crowned with success. Sectional packing rings of bronze or cast iron, or both combined, seem to give some advantage when carefully installed.

Valve Bushings

There has been a growing tendency to use more and wider bridges in valve bushings. This has been especially noticeable since the introduction of sectional packing rings. From the standpoint of steam efficiency this practice is very objectionable, as it still further restricts the port area.

If the width of the port is proportioned to the sum of steam lap, lead, and exhaust clearance, it will take care of the exhaust opening at the end of the piston stroke, which is sufficient to take care of all requirements. Since the passing of continuous bushings, holding the split bushings to the specified distance between ports has become a problem. In order to back up the keeper plugs against partial or momentary seizure between the valve and the bushing, valve bushings should be provided with two or three lugs which extend to the joint on the valve-chest heads.

Maintenance of Piston Valves

The importance of properly maintaining piston valves cannot be over estimated. Besides the loss from leakage when considered from the viewpoint of steam economy or operating efficiency, steam leakage past the rings need not be very noticeable to cause an appreciable loss of power. Leaky valve rings are not only wasteful of steam but they make adequate valve and cylinder lubrication difficult of accomplishment. As a result frictional resistance is greatly increased, resulting in greater load on the valve gear, and loss in horsepower output of the locomotive. Here, as elsewhere, precision workmanship is the cheapest in the long run. When valve chambers are accurately bored with a smooth finish, and rings finished turned to the exact bore of bushings, steam leakage becomes almost nil, and lubrication is greatly facilitated. This means effective service at low cost on a mileage basis.

By far the best method of boring valve chambers is by means of a 12- or 14-cutter reamer. This can be used in connection with the standard portable boring bar by replacing the usual two-tool head with a special multiple-cutter head. It has the overwhelming advantage of giving a very smooth and accurate job in about half the time ordinarily consumed. The best fitting packing rings are turned to the old piston ring rule: from $\frac{3}{32}$ to $\frac{3}{16}$ in. larger than the bore, according to the size of the valve; then from $\frac{3}{16}$ in. to $\frac{1}{2}$ in. cut out, the ring clamped in a jig and turned to the exact size of the cage.

Conventional Radial Valve Gears

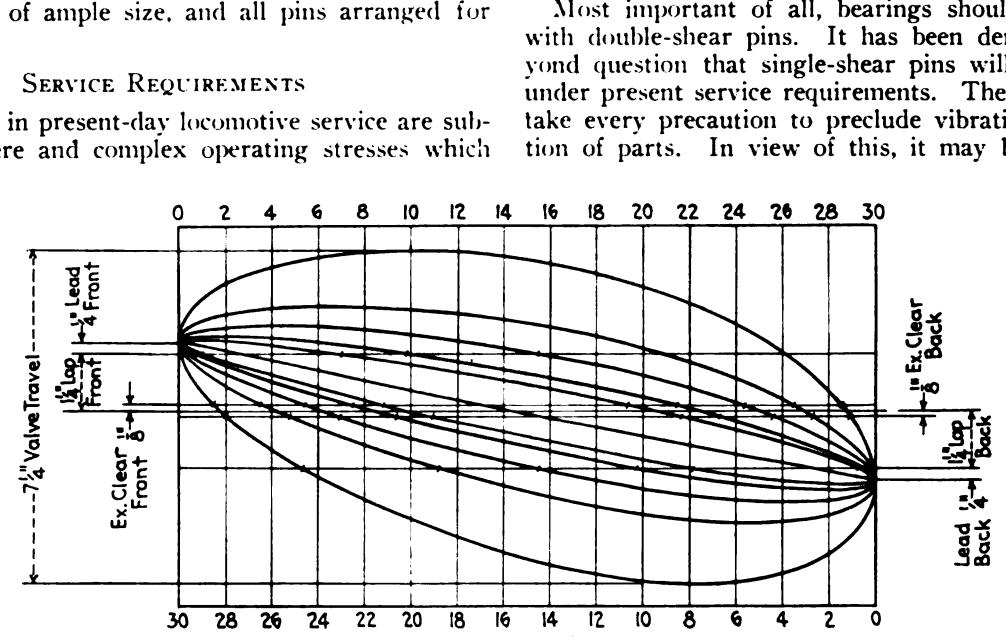
Walschaert and Baker Valve Gears

A study of modern high-speed locomotives indicates that there are only two valve gears, which are used to actuate piston valves. These are the Walschaert and Baker gears. Characteristically, they are much the same; both derive their motion from eccentric cranks and combination levers. However, the Baker gear with its pivoted members replacing the oscillating link of the Walschaert mechanism has capacity for greater travel. Both of these valve gears have demonstrated their ability

to meet all of the requirements of the most exacting service. From the standpoint of reliability in service, simplicity in operation, and ease of maintenance, these gears leave little to be desired. In fact, they are marvelously well adapted to modern locomotive service. The outstanding advantages are (1) low first cost, (2) low maintenance cost, (3) reliability in service, and (4) ability to hold adjustment. However, in order to insure these desirable characteristics the design must be such that all parts have the requisite strength and stiffness, with bearings of ample size, and all pins arranged for double shear.

Service Requirements

Valve gears in present-day locomotive service are subjected to severe and complex operating stresses which



Cut-off, per cent	Cut-off, in.		Release, in.		Compression, in.		Pre-admission, in.		Steam port, in.		Exhaust port, in.	
	Front	Back	Front	Back	Front	Back	Front	Back	Front	Back	Front	Back
24.8	7	7 7/8	19 3/8	19 1/16	8 11/16	8 3/4	7/8	3/4	1 1/16	3/4	1 3/4	1 1/16
33.4	9 15/16	10 1/4	21 3/8	20 5/16	7 1/2	6 11/16	5/8	1/2	1 1/16	1 1/16	1 15/16	1 1/16
50.0	15 1/2	14 1/2	24 1/4	23	5 7/16	4 5/8	3/8	1/4	1 1/16	1 1/16	2 1/16	1 1/16
66.0	20 5/16	18 5/16	26 1/2	25 1/4	3 5/16	2 5/8	1/8	1/8	1 1/16	1 5/16	2 5/16	2 1/16
84.6	26 1/16	24 11/16	28 5/16	28	1 1/16	1	1/16	1/16	2 1/16	2 1/16	3 1/16	3 1/16

Characteristic valve events attainable with Walschaert valve gear

are difficult to analyze. The duties which they have to perform are exacting in the extreme. Higher speeds and more intense utilization of locomotives has made service requirements more severe, and increased the hazard of engine failures. What is required is a valve gear with demonstrated reliability, and which will stay square from shopping to shopping with a minimum of up-keep. Both the Baker and Walschaert gears have shown their ability to do this. It should be repeated that stresses in valve gears increase with the speed, cut-off, and weight of valves; also that the inertia forces in the valve gear vary as the square of the speed.

Design and Construction

Because of the extremely severe service to which valve gears are subjected in modern high-speed service, the utmost care must be taken in their design. Various efforts have been directed toward improving their movement, but none of these have met with success for the reason that too much complication is involved. Nevertheless, the urge to produce new valve-gear attachments continues and, as might be expected, few of these get farther than the drawing board.

In view of this the emphasis has been upon refining the design, eliminating proved points of weakness, and stiffening the actuating mechanism, rather than upon improving the steam distribution. As a result progress has been made along the lines of lower maintenance costs and greater reliability in service.

The weight of the valve-gear parts themselves is an important factor, and the trend is toward light-weight gears employing special steels of high strength properties. Precision of movement is dependent upon stiffness of the parts, and the absence of lost motion in the bearings. Parts should be proportioned so that they have the maximum strength with minimum weight.

Most important of all, bearings should be arranged with double-shear pins. It has been demonstrated beyond question that single-shear pins will not stand up under present service requirements. The designer must take every precaution to preclude vibration and distortion of parts. In view of this, it may be advisable to resort to channeled section eccentric rods and combination levers in high speed service.

Equally important with the preceding consideration is the matter of crank throw. Due to the whipping action of the eccentric crank and of the back-end of the eccentric rod at high speed, it is desirable and necessary to limit the eccentric-crank throw so that the crank circle does not exceed 21 in. In the case of the Walschaert valve gear this means that the link swing must not be more than 45 deg. with a long link used as a compensating factor. With respect to the Baker gear, the gear connecting rod must be shortened to 16 in. All this results in small working angles, giving an easy and smooth-working valve motion.

Characteristic of Present Radial Valve Gears

The Baker and Walschaert valve gears do not give us everything that is to be desired in the way of port opening at short cut-off, but they give a reliability that is not to be expected of other arrangements. The fact that the port opening becomes progressively smaller as the cut-off is shortened is undeniably an undesirable characteristic. But, as has been shown, it is not as serious a defect since the introduction of smaller cylinders and highly vitalized steam. Various notable attempts have been made during the past to improve steam distribution by introduc-

alve mechanisms which give quicker valve movement nd less port restriction, but none of these have survived. t is well known that the conventional piston valve actuted by our present valve gears imposes certain restricons on power output at speeds. But a slight sacrifice ı power is preferable to operating and maintenance ifficulties.

Finally, with reference to valve events, what is most esired is uniformity. This is a function of the charcteristics of the valve gear as affected by design. The aker valve gear is very satisfactory in this respect even hen long valve travel is required. With reference to ıe Walschaert valve gear, it can be said that within its mitations of travel this gear can be designed to give ıfficiently uniform valve events. But when the travel extended beyond 7½ in. there is considerable irregurity.

Multirol Needle Bearings

Among the outstanding developments and tendencies ı valve-gear construction is the trend toward anti-fricon bearings at all pin connections. These needle bearigs have great load-carrying capacity in proportion to ieir size. They are a self-contained unit with a series f small rollers or needles running between inner and uter races, which are held in place by heavy snap rings n each side of the bearing. Because of their small overll size, they are in some cases interchangeable with exsting bronze bushings. Bearings are completely inlosed, which keeps out dirt and grit and makes lubricaion simple.

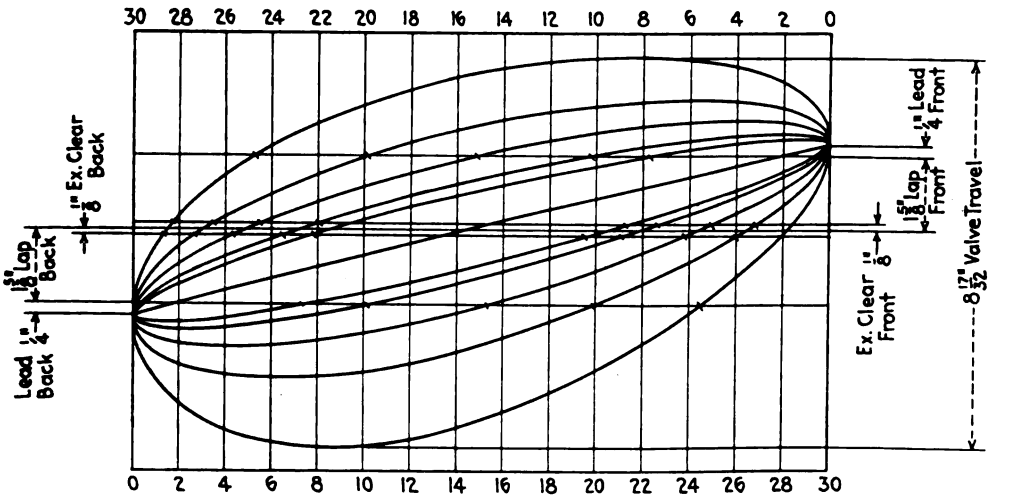
The application of needle bearings eliminates the play nherent in friction bearings and thus greatly reduces he shock load on the valve gear. There is the further dvantage that at high speeds the distortion in valve vents due to whip is eliminated. A particular virtue of eedle bearings is their ability to maintain effective team distribution for long periods without maintenance ost. The fact deserves notice in this connection that they require very little lubrication and will run from 1,500 to 2,000 miles between lubrication periods.

An interesting sidelight bearing upon this subject is the experience gained on one railroad by substituting roller bearings for Walschaert valve-gear link blocks. As the link block is a critical point in the Walschaert gear, at the outset this seemed like a rather hazardous undertaking. But in view of several years of successful operation on about 25 high-powered locomotives the practice seems to be justified.

Valve Setting

The art of valve setting resolves itself into getting the best possible steam distribution from a given design and arrangement of valves and valve gear. Any discussion of valve setting invariably brings out conflict of opinion on the relative merits of the various methods used. It still remains true that the desired objective is to obtain good equalization of power. So long as this is attained the precise method used is not so important.

Lead itself does not vitally affect steam distribution but equalization of the lead is important because in a well designed gear this is the best means of insuring approximate uniformity of the other valve events. Hence, it appears logical that lead should be the basis of valve setting. In consequence of the foregoing, we recommend that the port openings and cut-offs in the running position should be equalized after a preliminary adjustment of the lead. Regarding the long cut-offs, which are only used for starting and slow speeds, it should be noted that square port openings are not essential to good distribution of power provided the cut-offs are fairly well equalized. At the short cut-offs, however, which are used at high speeds, close equalization of the port openings is as important as equalization of the cut-offs.



Cut-off, per cent	Cut-off, in. Front	Cut-off, in. Back	Release, in. Front	Release, in. Back	Compression, in. Front	Compression, in. Back	Pre-admission, in. Front	Pre-admission, in. Back	Steam port, in. Front	Steam port, in. Back	Exhaust port, in. Front	Exhaust port, in. Back	Yoke position, in.
25.3	7 3/4	7 7/8	20 7/8	19 7/8	8 7/8	7 7/8	9/16	7/8	1 1/4	1 1/4	2 1/4	2 1/4	14 5/8
33.7	10 5/8	10 1/8	22	21 1/8	7 7/8	6 7/8	3/8	1/4	1 1/4	1 1/4	2 1/4	2 1/4	13 5/8
50.5	15 1/8	15 5/8	24 5/8	23 3/4	5 1/8	4 1/4	3/16	1/8	1 1/4	1 1/4	2 11/16	2 1/4	12 1/2
66.2	19 1/8	19 7/8	26 5/8	25 15/16	3 1/4	2 11/16	1/8	1/16	1 1/2	1 1/2	3 1/4	2 1/4	11 1/16
81.9	24 3/4	24 7/8	28 3/8	27 7/8	1 11/16	1 1/4	1/16	1/16	2 1/4	3 1/8	4 7/8	3 1/4	9

Valve events obtained with the long lap valve and Baker gear

Elliptical Valve Diagrams

Unquestionably, the best method of determining valve-gear characteristics is by means of a full-size valve model to which an ellipsometer has been attached. The ellipso-

meter is a device which records graphically the precise movement of the valve correlated to that of the piston. This oval or elliptical diagram affords a very simple and convenient means of analyzing valve movement and valve events. It gives a graphic picture of what takes place. Piston stroke is represented by its length and valve travel by its width. As usually arranged, its length is proportional to one-half of its width. If reduced in size these relative proportions are maintained. There is no better basis of comparison of different valve arrangements than the valve ellipse affords.

Some insight as to the effect of valve and valve-gear details and proportions upon valve events and valve movement can be had by comparing the accompanying ellipses. The first is an ellipse from a Walschaert valve gear with moderate valve travel and conservatively selected valve details. Next is an ellipse from a Baker gear with long valve travel and fairly wide steam lap. Even a superficial examination will quickly disclose the advantage derived from the latter arrangement. It strikingly illustrates the merits of long valve travel and wide steam lap.

Valve events and valve movement can be checked on a drawing board by laying the gear down and checking the kinematic movement. This is a laborious procedure, and not altogether satisfactory. A complete valve record taken from an actual locomotive provides an accurate means of checking valve events, and is useful in determining valve-gear characteristics, but is slow and costly.

Cut-Off the Chief Factor in Locomotive Operation

Valve Pilot

Observations of students and engineers based on dynamometer-car and testing-plant data abundantly prove the contention that there is a cut-off which for every speed will give maximum power and economy. The Valve Pilot functions on this definite relationship between speed and cut-off. Briefly, it combines a speed recording device with a cut-off indicator and recorder, which is actuated by the reverse shaft of the locomotive through a cam mechanism. In this connection, it is of interest to note that the cam is designed after a careful check of valve gear characteristics, and other pertinent data. By thus synchronizing speed and cut-off the Valve Pilot standardizes the variable man factor in locomotive operation. As can readily be observed, it is not an automatic controller. The control still remains in the hands of the engineman, where it properly belongs, but it invariably indicates the correct method of operation, which if followed will give maximum power and speed.

Short Cut-off Operation

It has already been shown that it is usually ineffective to attempt to get greater power output at speed by lengthening the cut-off. On the other hand, as speed increases the cut-off must be shortened; the higher the speed (revolutions per minute) the shorter must be the cut-off for maximum power. This is a matter of inlet and outlet valve port-area ratio, which varies with the cut-off, increasing as the cut-off is shortened. Shorter cut-offs at high speed tend to offset the increase in back pressure brought about by the higher piston speed. However, it must be recognized in this connection that the conventional arrangement of piston valve and radial valve gear is critical in this respect, and unless unusual refinement has been used in fixing the details, cut-offs shorter than 25 per cent are not practical, in spite of the fact that higher steam pressure, more lead, a larger valve, or a larger cylinder make it possible to work at a shorter cut-off. It is a matter of the disturbing effect of higher negative forces.

Power Reverse Gears

Viewed from the standpoint of effective valve-gear performance the power reverse gear is an adjunct of vital importance. It must hold the valve gear at the desired cut-off without creeping or shimmying, and it must give fine adjustment. These requirements are difficult to meet, and reverse-gear trouble is all too frequent. It is hard to escape the conclusion that in most cases maintenance is at fault.

A simple means of insuring more dependable operation from power reverse gears is to replace the usual reverse-shaft bearings with J. M. friction bushings. The material used in these bushings is somewhat similar to brake lining, and it sets up an initial resistance which is helpful in overcoming the sensitiveness of troublesome reverse gears.

Conclusions

From the foregoing considerations it seems reasonable to conclude that if the full power potentialities of the locomotive are desired and necessary the port areas must be liberal. This means that the valves must be of sufficient diameter, and arranged for wide steam lap. Furthermore, in order to insure free steam flow through the passages these should be of ample area and streamlined. And, finally, nothing is more important than a properly designed boiler which delivers steam of high quality, and in sufficient volume to meet all requirements, without requiring excess back pressure for draft. Otherwise the most efficient valve and valve gear arrangement will be ineffective.

In conclusion, let it be said that the limit of effectiveness at high speed is the ability to pass steam in sufficient volume to maintain the mean effective pressure. It should be clear by now that the important factors in steam action are mean effective pressure and steam consumption.

Mechanical Department Employs Many Women Workers

(*Continued from page 307*)

women constantly on the job to impress on the minds of our women that there is a right way to do everything.

In handling women's problems there are so many seemingly unrelated things to be taken care of, in order to keep the trains rolling. The human interest angle is endless. The loss of a baby, that difficult time when son, sweetheart, husband or brother is sent across, are times when we need to have double consideration and understanding. Or we have a problem equally important at the moment, such as Mrs. Garcia's, who comes up to my office all in a dither with, "Oh, Mrs. Tibbet, what can I do? My mother or neighbor, or whoever the case may be, can't take care of my children any more." We know she can't work and leave her children alone, so we refer her to the day nursery nearest her home. Or perhaps her problem is an erring husband.

All these help to keep people happily on the job. We have reunions, weddings, the lead work woman has a birthday and her group treat her to a birthday cake and gifts. Emotions play a large part in the psychological problem of the employment of women.

Tribute to

Otto Jabelmann

British railway executive tells of his mission to England

OTTO JABELMANN, vice-president — research and mechanical standards, Union Pacific, went abroad last fall on a special mission in connection with lend-lease distribution. The purpose was to give any help he could to the British railways, and especially regarding mechanical matters. He died suddenly in London on January 6. Sir Harold Hartley, vice-president of the London, Midland & Scottish of England, who is widely known in this country, came in intimate contact with Mr. Jabelmann and has recently written the following impressive tribute to him:



Otto Jabelmann

"The sympathy of British railwaymen goes out to their American colleagues at the sad death of Otto Jabelmann while on a mission to this country. Although few of us had known Mr. Jabelmann previously, all who met him realized quickly how admirably qualified he was to discover in what ways the United States could help us most to solve some of the war problems of the British railways. With his long operating experience, his great technical ability, his quick eye and his sympathetic approach to any problem he quickly won the confidence of his British colleagues. We knew of the great work he had done in the development of the Diesel-electric streamliners and the articulated steam locomotive on the Union Pacific, but were not perhaps prepared for the swift and discerning way in which he grasped our problems, which are so very different from those of his own railroad.

"As soon as he arrived he said he wanted to see things for himself, and during his short stay here he made a good many journeys, visiting railway shops, roundhouses, and marshalling yards, and wherever he went his keen observant eye was marking down points for discussion with us. We were particularly grateful to him because, in spite of the great differences between his rolling stock and operating conditions and ours, he saw so quickly the causes of our difficulties and the quickest means of overcoming them.

"One night at dinner he met a group of works superintendents and the heads of our research sections, and he gave them a most stimulating talk which they will long remember. Starting rather shyly in his modest way, he first paid a generous and discerning tribute to the war effort of the British railways. Then he told us a little about himself, and as he warmed to his subject he gave us a fascinating account of the developments on the Union Pacific—his two years in Chicago working out the details of the streamliners; and the problems that had to be solved in the newer types of steam locomotives. He was talking to a technical audience, and they enjoyed enormously his infectious enthusiasm and the clarity with which he explained the logical train of thought and resourcefulness that lay behind each technological development. It was a great experience to listen to him, and afterwards they talked with him in turn, each carrying away some new idea, some fresh slant on their problems.

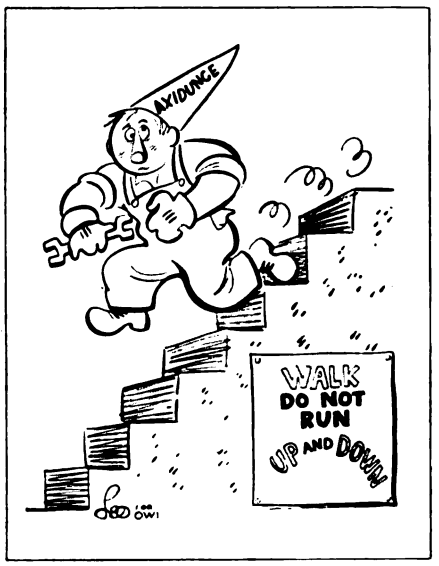
"His last journey to Scotland I made with him in a business car, and ten hours never seemed to pass so quickly. Very little escaped him, and the engineers who were with us were kept busy answering questions. There's a good deal of history in the line from Euston to Glasgow, and Mr. Jabelmann seemed to enjoy it all so much.

"When it got dark I suggested pulling down the blinds. 'No,' said Mr. Jabelmann, 'I always sit in the dark and watch the road; you see things by night you don't see by day.' Within a few minutes we passed an engine with its brakes badly adjusted and sparks flying from one wheel. 'Now you couldn't have seen that by daylight,' he said.

"In Scotland he spent a good deal of his time at a roundhouse, studying the diagramming of the engines and the methods of repair. No detail was too small for him; nothing seemed to escape his eye and the staff thoroughly enjoyed his visit.

"Two days later, after a visit to a locomotive works, he collapsed, and died shortly afterwards. He had caught a cold on the journey to England; he knew he was not fit, but he was unsparing of himself on his mission. And so he gave his life to the cause of the United Nations, busy and active to the end."





Accidents Worse Than War

Many more workers are killed and maimed by accidents in this country than are those numbered in our battle casualties

ELMER DAVIS, director of the Office of War Information, has pointed out that "job accidents have killed more of our productive workers than have the Nazis and Japanese, maimed millions and cost more production time than almost any other cause." Based on the results that have been obtained by the National Safety Council over the years, there seems little question but that a very considerable part of these casualties could be prevented if the managements and workers could be made more safety-minded. This involves more effective safety education programs and a more thorough and studied use of safety devices.

The Committee to Conserve Manpower in War Industries of the United States Department of Labor has prepared a list of "do's and don'ts to keep workers from getting hurt." In introducing the first of these releases it makes the statement that;

"Job accidents in the United States from July, 1940, to January, 1943, the 30 months covering the defense program and the first year of war, brought death to 48,500 workers, cost 258,000 an eye, finger, hand, arm or leg, and laid up 5,300,000 for an average of three weeks each. Days of work lost in these accidents totaled 110,000,000—more than 375,000 man-years. In the first 18 months of the war, our announced battle casualties have numbered 12,123 dead, 15,049 wounded; 40,435 missing and 10,628 prisoners of war, a total of 78,235."

Seven of the series of nine sets of safety suggestions are so applicable to railway mechanical department operations that we are reproducing them herewith:

General Suggestions

1. Work in the shop only when you are physically fit and provided with the proper equipment, tools, and safety devices. Tell your foreman if anything is wrong.

2. Report all unguarded machines or unsafe or insanitary conditions to your foreman or safety committeeman at once.

3. Small cuts or scratches may become infected. Get first aid at once. Report all injuries promptly.

4. Walk—do not run—up and down stairs. Watch your step and keep your hand on the rail. Keep to the right in passing others who are approaching from the opposite direction.

5. Scuffling, horseplay, and practical jokes are dangerous and childish—act your age.

6. Do not use an air hose for dusting clothes or hair. Do not fool with compressed air or blow it at anyone else.

7. Never attempt to enter or leave an elevator while it is in motion, or to operate one unless specifically authorized and instructed how to do so.

8. Do not distract the attention of persons engaged in exacting operations.

Personal Protection

1. Wear snugly fitting clothes. Never wear loose clothes, long sleeves, dangling neckties, loose trouser cuffs, finger rings, or other unsafe apparel while working around machinery.

2. Wear suitable gloves and gauntlets when handling sharp-edged stock, scrap, or quantities of lumber.

3. Wear goggles when grinding, snagging, chipping; pouring hot metal, caustics or acids; welding, sandblasting, or doing any other work where flying or splashing material might enter the eyes (unless an effective nonshatterable shield is installed on the machine). Do not

nterchange goggles, masks, or other personal protective equipment without first having them sterilized.

4. Wear shoes with soles sufficiently heavy to give adequate foot protection. Use safety shoes when handling heavy objects.

Machinery

1. Stop machine or other dangerous operations while listening to instructions.

2. Before cleaning, adjusting, or oiling a machine, make sure that the power is off.

3. Never reach over moving cutters, rolls, or other dangerous machine parts.

4. Always remove chuck wrenches from chucks immediately after they have been used.

5. Stand out of direct line with rapidly moving or revolving machine parts from which objects may fly. Do not stand in line with materials being fed to circular saws or jointers.

6. Always use a push stick when feeding short or narrow work past saws or knives. Keep fingers away from moving machine parts.

7. When operating any machine, do not lean over the work so that your hair or clothing may be caught in any moving part.

8. Do not start any machine unless safeguards are in place and working properly. Machine guards may be removed only to make necessary adjustments and repairs, and must be replaced before the machine is again put into operation. If guards become broken or inoperative, the machine should be shut down until it can again be operated in a fully guarded condition.

9. Never attempt to stop a machine by grabbing the belt or by using any part of the body as a brake.

10. When replacing the belt, stop the machine and adjust belt on the driver pulley first.

11. When shifting a belt, use belt shifter or a small metal or wooden rod. If you must shift by hand, always use the palm with the thumb and fingers extended.

12. Metal belt fasteners should never be used on hand-shifted belts.

13. Remove chips or materials from around moving machine parts with a brush or stick, never with the hand.

14. Keep loose materials away from machinery. Do not use rags or waste around moving machinery parts.

15. Machines should be stopped before attempting to pick up tools or other objects lying near or in the path of traveling parts.

16. Always turn off the power on a machine before attempting to remove stuck or jammed pieces of material.

Hand Tools

1. Use only tools that are properly sharpened and in good condition.

2. Use suitable shields to cover the dangerous parts of sharp-edged or pointed tools that must be carried about.

3. Use only tools free from broken or splintered parts. Be sure that hammer heads are secure on handles.

4. Chisels, hammers, or other tools on which the heads have become mushroomed should not be used.

5. When using wrenches, be sure that the jaws are not sprung and that they are properly applied to the nut, so that the wrench handle will turn in the direction in which the jaws point. Never use a wrench or any other makeshift as a hammer.

6. Use wrenches properly sized for the job; be certain that the wrench is correctly applied to the nut or bolt head. Where necessary to push against a wrench handle in close places, push with the hand open.

Ladders and Scaffolds

1. Use care in placing a ladder; the foot should be one-fourth of the ladder length away from the wall against which the ladder is leaning.

2. Do not leave tools on top of a stepladder or on any other elevated place from which they may fall. Effective tool holders should be used.

3. Place ladders only against solid and stationary backing.

4. Always face the ladder when ascending or descending. Use both hands going up or down a ladder.

5. Use only ladders in good repair. Never use a broken or weak ladder or a ladder with missing rungs.

6. No uprights, braces, or supporting members of any scaffold should be removed, loosened, or weakened while any of the scaffold planking or flooring is in place.

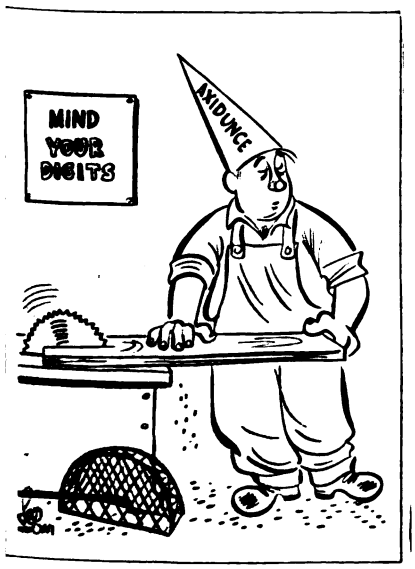
Material Handling and Storing

1. Learn to lift the right way. Keep the body upright; lift with the leg muscles and not with the back. Do not try to lift too much. Get help if necessary.

2. Wear hand pads or gloves when handling sharp-edged scrap or rough material.

3. Remove all projecting nails from barrels, crates, and all other places where they might cause accidents.

4. Keep floors clean. Oil or water is especially dan-











gerous on floors near machines, near sharp-edged tools or materials.

5. Do not use gasoline or other inflammable substances in a closed room or near an open flame or on a hot surface.

6. All oils, paints, and other inflammable or explosive substances should be stored in specially provided safety containers, and only small quantities of such materials (never more than a day's supply) should be taken into the workroom at one time. Containers for inflammable substances should be marked with proper identification and never used for any other purpose.

7. Arrange materials carefully and securely. Do not pile or place objects or materials near machines or in such a position that they can fall over or block passageways.

8. When piling materials, do not leave projecting edges or points against which someone may strike.

9. Put all scraps and waste materials into proper receptacles. Keep oily and paint-covered rags in closed metal containers.

10. Keep all aisles and exits clear.

Broad Recommendations

1. *Work Safely.*—Find the safest way to do each job, then do it that way until it becomes a habit.

2. *Use Guards.*—Use all machinery guards and pr tective equipment provided for your use.

3. *Observe Safety Rules.*—Keep from getting hurt b observing safety rules and instructions.

4. *Report Hazards.*—Report to your safety commi teeman, foreman, or supervisor any hazardous conditio that you find on your job.

5. *Fellow Workers.*—Watch out for the safety of you fellow workers.

6. *Safety Committees.*—Work with the safety com mittee in your shop. If there is none, try to organiz one and assist in its work through safety and health ha ard check-ups, inspections, and accident investigations.

7. *Personal Hygiene.*—Ability to produce depend upon physical fitness; therefore, use all sanitary and hy gienic facilities provided. Do not eat at your bench.

8. *Neatness.*—Since "housekeeping" is an effectiv safety measure, keep your bench, machine, or other work place clean and neat.

9. *Cooperate.*—Cooperate with the government, wit your employer, and with your fellow workers in thei efforts to reduce industrial accidents and diseases.

10. *Remember.*—Remember that it is your life, you health, your limbs, your pay envelope, and your family' welfare. Make sure that your job is safe—first, las and always.







EDITORIALS

What Can Be Done?

Modern locomotives—fine specimens of machinery that are utilized and stressed to the limit of their capacity—require the very best of care to protect them and keep them in prime operating condition. Unfortunately, a little carelessness in finishing some of the parts, or hammer marks, nicks, torch burns, etc., incurred in their operation and maintenance, may and do develop into major defects that cause failures. Such things must be carefully guarded against and prevented. What can be done to protect and insure vital machinery part surfaces from such abuses? That is a question that we should like to have answered in our August Roundtable discussion. Your letter must reach our New York Office as promptly as possible, and not later than July 15.

Plastics and Their Use on the Railroads

The result of the roundtable discussion on the use of plastics in car construction, which will be found elsewhere in this issue, is conclusive in one respect, at least, and that is, that railroad mechanical men have had only very limited experience with the use of plastics. There is a lack of specific information about the properties and characteristics of the newer forms of this material, which are reported to be giving excellent results in war equipment. In light of the very obvious need for more information about plastics and the possibilities for their use by the railroads, the *Railway Mechanical Engineer* is preparing an article for publication in a later issue, that will more fully meet the needs of the railroad mechanical department.

The educational work in familiarizing motive power and rolling equipment officers with the characteristics of these increasingly useful products will undoubtedly be carried on by all manufacturers who are interested in the railroad field as an outlet for their productive capacity which is now almost fully occupied in the output of materials for the war effort. Probably many of the prospective uses are not even being thought of by either the manufacturers or the railroad officers who will be responsible for adapting plastic materials to railroad requirements. It is our hope that the publication of basic information will be helpful in providing a background for study and will encourage designers and producers to consider carefully the introduction of plastic structural materials and accessories better, or as good while being cheaper, than those now in use.

Watch That Curve Now That Summer Is Here

Once again it is time for those who prepare the graphs on hot boxes to sharpen their pencils and cock their straight edges upward on their charts. It would be too much to hope that this annual upward tendency will not occur this year; the chances are that history will repeat itself and the steep climb during July and August will again take place. This is an open invitation to any road which succeeds in flattening out the curve to use our columns to tell their brother railroaders how the feat was accomplished—such information should be broadcast promptly in the interests of the railroads as a whole.

In our June issue four pages of comments from men intimately associated with this problem were published in your *Roundtable*. While it is evident that none of those who participated were able in a short contribution to explore the field thoroughly, it was interesting to note the various points which each chose to emphasize. A determined effort along any single line may result in an appreciable drop in hot journals; a determined campaign along all lines should effect even greater reductions.

Once more it will be that much overworked individual, the supervisor, who must bear the brunt of this demand for fewer hot boxes. Several of the contributors to the *Roundtable* indicated their belief that, with certain practices known to be of help, it was the duty of supervision to see that the practices were followed out to the letter. Those who did not specifically refer to supervision, but who suggested remedies, certainly had in the back of their minds the fact that supervision alone could make the remedies effective.

It will be a hard summer; loadings are increasing, cars will be in great demand, time for adequate attention to the boxes will often be at a premium and the labor problem will not improve. But somehow the problem must be licked; war necessities demand that the traffic movement be speeded up, and this requires the elimination of those factors that slow it down. Hot boxes are not the least of these handicaps.

Relation of Light to Safety

Artificial lighting is installed in railroad service for two primary reasons—to allow employees to work efficiently, and to provide for the movement and comfort of passengers. It is also generally accepted that good lighting promotes safety, but very little quantitative data to prove this point is available. The reason for this lack is obvious since there are few places where accidents occur at a rate to permit the collection of conclusive evidence in a reasonable time. The New York subways, however, afford such an opportunity since they carry more than 5,000,000 passengers daily. Subway train accidents are rare, but people fall while hurrying down stairs to catch a train, when stepping across a space between a car and platform, etc.

A paper on the relation of light to safety was presented before the Illuminating Engineering Society on June 11 by E. E. Dorting, supervisor of lighting, New York City Transit System. Mr. Dorting's findings are based on extensive studies of stair and platform lighting, and over periods varying from 4 to 32 months he has been able to collect some convincing data. His platform lighting was resolved into the use of low general illumination (0.1 foot-candle) with higher values (4 to 6 foot-candles) on platform-edge strips consisting of 8-in. sq. yellow terrazzo tiles. The dark colored platforms reflect only 5 per cent of the incident light while the tiles reflect more illumination, but one which does not cause troublesome glare. Studies made in stations used by as many as 100,000 passengers daily showed that the lighting effected a reduction of accidents of 52 per cent.

In the case of stairs, it was found that good lighting was of little benefit unless the stairs themselves first met certain specifications such as: Riser heights which do not vary more than ⅛ in. plus or minus; definite relations of riser height to tread width (7 in. by 11 in. are given as a good value); landing widths equal to at least two average human steps; level treads and landings; tread edgings in line; handrails on both sides with a center rail when stair widths exceed 132 in.; stair treads which reflect 50 per cent of the incident light. Given these conditions it can be proved that good lighting, which is applied particularly for those descending the stairs, will materially reduce accidents. Based on a series of stair-lighting studies showing varyi results the author says, "the intelligent application artificial illumination should reduce the number accidents by at least 50 per cent."

With relation to lighting for railroad workers, it interesting to note that the number of accidents sulting in personal injuries rise and fall at a rate wh is much greater than the rise and fall in the number employees. As an example, during 1941 and 1942 wh the number of railroad employees increased 24 per ce fatalities to non-train employees on duty increased per cent and injuries increased 88.6 per cent. C versely, during 1931 and 1932, when employment clined 30.7 per cent, the decreases in fatalities and juries to the same class of employees were respectiv 63.5 and 53.1 per cent. Other periods show simi trends.

The increased number of accidents is probably due part to the use of relatively inexperienced workers a partly due to the fact that routines are upset and a la part of all employees are required to perform unfamil tasks, work which makes it necessary for them to what they are doing.

The obvious suggestion, based on Mr. Dortin findings is that light can also be used advantageou to reduce accidents to employees as well as passenge Railroad properties, due to their sprawling charac and the presence of much smoke and dirt, present difficult lighting problem. It is not to be supposed t all areas could be well lighted; and under present ma rial restrictions, the relighting of even strategic a important points may involve almost insuperable di culties. It is, of course, possible to carry on with adequate light, but experience with blackouts has prov that it greatly increases the accident rate. Saving material is important, but it would appear that m attention to lighting might result in an important savi of man power.

How Much Do Shop Men Care?

By and large, there is no question about the faithf ness and loyalty of railway shop supervisors, mechani machinists, helpers and, in fact, employees of classes. They realize the vital relation of their wo to the war effort and appreciate the opportunity to ma a livelihood in an industry which contributes so mu to business progress and national welfare. Unfo tunately there are some exceptions, and instances carelessness or indifference occur which really in way disprove the rule.

For example, one railroad which had embarked o car building program recently transferred its lar bending brake, practically a new machine, from the c shop to the boiler shop where the particular set-u

mitted steel sheets to be flanged and shaped with luced handling expense. The machine was designed bend 12-ft. sheets up to ⅜ in. in maximum thickness d this capacity range was, or should have been, inly shown on the name plate, or some conspicuous rt of the machine, for the information of all who used

The instructions, if given, were disregarded and a ge steel sheet, ⅝ in. thick, was inserted in the brake, using a failure of the side housings and pressure-plying machinery which put the brake out of com-ssion for a considerable period of time; entailed a able item of expense for the replacement of parts; and, ssibly even more costly in the long run, interfered th production and delayed the completion of freight rs badly needed to move war and civilian traffic.

Machinery accidents are sometimes caused by shop en who do not have any "feel" regarding machine pacity and are skeptical about rated capacity limits. onsequently, they simply keep on increasing the load, eed, or feed, as the case may be, until machines will ld together no longer. Such abuse, which tends to eak the heart of any real lover of fine shop machinery, ust be charged to bad judgment and ignorance, and en with such characteristics should not be permitted operate shop machinery, certainly not unless it is lly protected with automatic safeguards.

The other type of man who should be kept away from achinery is the one who is indifferent and careless. e calls to mind the story of the farmer who was har-wing between rows of young corn and discovered that s mule was wabbling from side to side and stepping 1 nearly every other hill. Questioned as to whether e mule might be blind, the farmer said, "No, he ain't ind. He just don't give a damn!" It is well for the ilroads and the country at large that not many men sponsible for operating railway shop machinery, or uipment can be placed in a similar category as regards relessness.

What Price Supervision?

he lot of the supervisor or foreman on most railroads as never been an especially happy one. True, such ositions usually carry with them a certain element of ob security in bad times which tends to make up for ng hours spent on responsible jobs. But today super-isors are getting tired; the pressure has been on for veral years and life has not been made easier for them y the large turnover in help and the shortage of repair aterials now common on all roads. That these men ave carried their share of the load efficiently is evi-enced by the low bad-order ratio of freight car equip-ent and the excellent maintenance of locomotive ower.

The need for additional supervisors in the mechanical epartment has been emphasized before; the need now for the recognition of supervisors as contributors to efficient production is becoming increasingly evident. With the increase in working hours at many back shops, car repair and inspection points which requires the payment of overtime to mechanics, helpers and laborers, a supervisor frequently finds that, on pay day, his men have drawn more money than he has himself. He cannot help but reflect that he, too, had spent the same working hours, and usually more, on the job and, in addition, was responsible for the quality of output. With the present recommended increase in pay rates for non-operating employees the situation will not improve.

Morale is a vital factor in maintaining an efficient working organization in any industry. Supervision is usually depended upon to contribute very largely to the creation and maintenance of morale or job enthusiasm. When foremen are dissatisfied the results must inevitably be reflected in their own work and that of the men who depend upon them for leadership.

Some roads have recognized the importance of the supervisor in the framework of their organization. One system has recently gone to a six-day week for foremen with a limit of nine working hours per day. Time over 54 hours is paid for as in the case of all workmen who are required to put in overtime. Other roads are understood to have similar arrangements or to have attempted to limit the hours on duty required of foremen.

In other instances, however, determined efforts are being made by supervisory personnel to organize foremen's unions. Such movements are receiving the interested attention and support of the organizers and representatives of the non-operating brotherhoods. It is too early in the game to know what the results will be but it is not too early to hazard the guess that foremen's unions will add one more big headache for the officers of any road on which they establish a foothold.

We have for years contended that the worth and value of foremen on the railroads was not always considered by management, especially in the matter of hours of work. We regret now to see that these men are being forced into organized effort to better their lot. Undivided allegiance and loyalty to management is a prime requisite in a good supervisor; divided allegiance and loyalty can only result in cases where management wishes and union policy conflict.

We have talked with many foremen recently in an attempt to estimate their true feelings with respect to organization. Almost invariably, on roads where the movement is gaining headway, the response is, "It's the only way we can get anything." Most of the men contacted are not really enthusiastic but, having waited for recognition which did not come, they are apparently willing to submerge their individuality in a union and attempt mass pressure. The eventual price to the railroads through the creation of another labor-management "problem" may be far greater than the present voluntary recognition of supervisors as co-workers with management.

Use of Plastics i

How About Shock Resistance?

I have a question—I wish to know the tensile strength or the shock that plastics can stand.—*J. P. Christiansen, Mechanical Engineer, Chicago, Indianapolis & Louisville.*

Plastic Specifications

Actual results in the field of plastics are perhaps less amazing than the claims which have been made by enthusiastic advocates. After the war is over, to judge by the advance publicity, railroad officials will be visited by the plastic salesmen, and there is certainly an opportunity for the *Railway Mechanical Engineer* to present a few of the basic facts regarding the origin and characteristics of various kinds of plastics. These have both vegetable and mineral origin, and probably combinations of the two. The physical characteristics of various compounds vary widely, particularly with respect to high and low temperatures. Some are sensitive to acids and some are sensitive to alkalis and the information available to the busy railway mechanical engineer is very limited.

As a suggestion, A. S. T. M. Committee D-20 on Plastics has recently evolved six specifications which are factual and informing. Other specifications are in course of evolution. A railroad officer who desires to fortify himself with information in this field would make no mistake in obtaining copies of these specifications, which are D-700 to D-705, inclusive.—*Engineer of Tests.*

Plastics vs. Metals

Up to the present time our experience has been confined to the use of various types of compositions for such items as table tops, window sill capping, transparent portions of partitions, lamp shades, moldings, ornamental trim and similar details.

Realizing the possibilities and advantages in extending the use of plastics for other purposes, we have given the matter considerable thought and study and while we are not yet in position to make any definite recommendations, we feel confident that after the war, when the materials will be made available for commercial purposes, a much larger field will be opened up and the use of plastics extended to include a great many items which have heretofore been of metal. The susceptibility to forming and practically unlimited selection of coloring are outstanding advantages favoring the use of plastics for interior trimming and decorations of passenger cars.

Believe we are correct in understanding that plastics cannot be used effectively for parts subject to stress or excessive vibration, except in connection with some sort of reinforcement, such as plywood or other foundation. The roundtable discussion will no doubt bring out some valuable information on this phase of the subject.

Another important question on which information is desired is the cost of molds. Investigation which we made sometime ago in connection with the possibility of substituting plastics for certain metal parts of parcel racks, developed that unless designs are fairly well standardized, the cost of molds would be prohibitive, which in itself would represent a handicap to injecting variations in interior treatment and fittings, in line with each road's desire to provide distinctive features in the building of new equipment or modernization of existing cars.

In addition to the interest in this subject on the part of the railroads, the industrial designers are actively exploring further adaptations and possibilities, and the experience which the manufacturers of plastics have had in developing numerous uses for their product in connection with the war effort will, we believe, place them in position to readily adapt their product and production methods to peacetime purposes.—*P. W. Kiefer, Chief Engineer Motive Power and Rolling Stock, New York Central.*

Passenger Car Uses

I, for one, believe that plastics will come into use, particularly in passenger equipment. If one can believe our chemists and manufacturers, not only plastics, but other synthetic products as well, can and will be used in car building and remodeling by the railroads.

In order to reduce the cost and weight of new cars, plastic panels can be used as interior finish. Moldings, window caps, curtain slides, venetian blinds, certain types of electrical control panels, towel dispensers, cup vendors and the like can be easily formed from plastics. It is not assuming too much to expect wash basins, dental basins and like equipment from molded or pressed plastics in the near future.

Where plastic panels and molding are used as interior finish, color schemes may be obtained when the plastic panels are manufactured; this will reduce one item of expense, that of repainting, which in itself is a considerable item over a period of years.

I believe we can look forward to certain types of plastic gears, pulleys, and even perforated air delivery grilles an the like, as manufacturers improve the equipment.

As for synthetic materials, cloths for u holstering, berth curtains, window shad and like equipment can and will be mad from synthetic fibers, while the uses synthetic rubber products such as air foa for cushions, mattresses, Duprene or oth like products for window seals, truck pad bolster anchors, buffer casting and gener tor mounting silencer pads may be univer sal on new cars.

Railroads and car builders should sta now to plan their post-war needs an equipment, in order to maintain their plac in the transportation field by use of mod ern passenger equipment that will meet th competition of other types of transporta tion, which are developing so rapidly.— *J. V. Dobbs, Car Lighting and Air Condi tioning Inspector, A. T. & S. F.*

Electrical Conduit Fittings

The use of plastics in car constructio raises the question of plastics for electri cal conduit fittings, which may be of in terest.

Plastic conduit would, of course, requir proper characteristics to combat the var ous physical and chemical conditions en countered, both underground and abov ground. Conduit and fittings would hav to be water-tight, heat resisting, fireproo mechanically strong, non-corrodible an have a long, useful life. The electrical or ganizations of railroads have long bee confronted with the problems brough about by rapid deterioration of expose conduit and fittings at enginehouses an associated facilities, due to gas, cinder and moisture. In many cases the ash an cinder fills make necessary special treat ment of trenches for underground runs conduit on railroad property, and eve then rapid deterioration frequently occurs

It is within reason to expect that de velopment could produce a plastic condui which would machine and thread to fur nish water-tight joints and even provid for making bends and offsets on the j in runs, without the necessity of fittings

Junction boxes of suitable plastic con struction would, with their dielectri properties, avoid one of the most frequen sources of trouble—abrading of the insu lation and grounding due to vibration. the sides or cover of the metal junctio box.

The equipment ground problem woul have to be solved (in some cases); how ever, the advantage of dielectric strength and freedom from electrolytic action shou

e considerable. A ground conductor ould readily be run with the other conuctors in the conduit, and satisfactorily olve this problem.

Light weight per unit of length should ontribute materially to facility in hanling and installation, particularly on the ailroads, where in many instances conduit ust be installed in inaccessible locations nd distant from the source of supply.

Expansion and contraction of long conuit runs should be considered in the deelopment of the material to avoid separaion of conduit and entrance of moisture nto the system. These are a few of the houghts which occur at the moment and ndoubtedly other problems would develop vith use; however, there certainly seems o be a definite field for additional use of lastics in the electrical branch of railoading.—*G. M. Heinze, Assistant Engineer, Electrical Engineer's Office, N. Y. N. H. & H.*

What Are Their Limitations?

The replacement of metals, generally, by plastic materials in car construction cannot be predicted in the present stage of development, because while great strides have been made in the plastic industry, especially in aircraft construction, this material is in its infancy, insofar as railroads are concerned.

At present even the most conservative car designer could not object to the use of plastic materials for interior decoration and trimmings of passenger cars and for non-stressed parts, such as panels, partitions, air conditioning ducts, ventilators, roof sections, etc., provided, under emergency conditions, other materials were not readily available and, under normal conditions, it could be economically justified.

It is thought that unless standard materials become more scarce than they are at present, plastics will not become prominent through their uses in railroad work during the present emergency, because with the tremendous job that is now being done by the railroads and the absolute necessity of handling this vast business quickly and safely, it would not be desirable to experiment with new ideas and unproved materials and designs.

A common carrier, particularly one handling the volume of public business that is handled by the railroads today, has to be very slow to change its general practices that have been proved and tested for years; therefore, if and when plastics are adopted as substitutes for metals, it will be necessary to first study closely the properties of this new material carefully, then conduct laboratory and service tests for a sufficient time to definitely determine that no chance is taken with the lives or property of the railroads and the public. Therefore, as stated previously, it is very doubtful that there is now available sufficient time or non-productive man-hours to undertake a problem of this magnitude.

Let us now look at another side of the picture; that is, let's look into the future of post-war conditions and suppose that plastics can be produced in great volume at reasonable costs, making them an economic competitor of metals. Our first thought is, will plastics be a safe substitute and what advantages will we hope to obtain from their use?

In order to answer the first part of this question we must first look to our test laboratories. We must know such things as tensile strength, toughness, hardness, fatigue resistance, etc. We must then conduct service tests, experiment with design, study weights and analyze resistances to know inherent defects caused in previously used materials.

In answering the second part of our question, let us look at some of the undesirable properties of the metal that leads all others in use, namely steel.

First, it is subject to corrosion. Second, it has to be varied in properties to produce wear resistance, strength or fatigue resistance. Third, it is subject to progressive failures starting from surface or material defects.

The best illustration of the desirability of obtaining a non-corrosive material to substitute for steel is in the case of open top cars, particularly those handling coal exclusively. If a plastic sheet could be developed that could be used for coal car sides, bottoms and hoppers that had the strength and toughness and that would be hard enough to resist the abrasion and at the same time be non-corrosive, it would revolutionize the construction of this type of car.

In thinking of wear resistance we think first of wheels, because approximately one-third of the cost of maintenance of freight cars is wheel expense. The greatest wear experienced usually is in the flange and tread; therefore, we may ask, why not increase the hardness? This has been done to some extent by heat treatment, but we know from experience that when a certain hardness is exceeded, we are liable to run into brittleness and the wheels are more susceptible to thermal cracking. Again, if plastic can be produced that will have the necessary strength and toughness to withstand wheel service and at the same time have sufficient hardness to produce a longer life, much will be accomplished in reducing car repair costs. This may sound like wishful thinking; however, we must not overlook the fact that compressed paper has been used as traction car wheels, consequently such a plastic may be in the realm of possibility.

The third property referred to in our list is especially troublesome in parts subject to stress reversals. In the case of axles, for example, numerous failures occur because of "tool marks," "rough fillets," nicks caused by handling or shipments of mounted assemblies of wheels and axles, etc. Likewise, there are numerous pipe failures that originate at the root of the thread brought about by vibration. If plastics could be developed that would have sufficient resilience to stand the vibration and still have sufficient strength, or if they were of such a fibrous composition as to resist the progressive cracks originating from surface defects, and yet have the other necessary qualities to meet railroad service conditions, their use may be far-reaching in car design.

In conclusion, it is well to repeat that the plastic child has not yet even reached the adolescent stage and it is now not possible to say how useful he will be when he grows up.—*J. B. Blackburn, Mechanical Engineer, Chesapeake & Ohio.*

Electrical and Ornamental Parts

So far we have not resorted to plastic materials, except in miscellaneous electrical plugs, attachments, lamp shades, and in a few cases, ornamental materials; however, I believe there is a large field for this type of construction.—*E. L. Cook, Mechanical Engineer, Seaboard Air Line.*

Almost Purely Experimental

We have read of the different uses which are being made of plastics, both molded and laminated, and naturally, since most of this plastic is going into war materials, it is a military secret and the details are not given out.

We have used molded plastics in items of passenger car finishes, and at the present time we are checking to see whether we can use molded plastics for our toilets where we desire to eliminate all corners, presenting a toilet room which can be flushed out with a hose and quickly and easily cleaned. This, however, at the present time is in a purely experimental stage.

I do not believe we will know definitely what can be done with laminated plastics in car construction work until more data is available as to what use has already been made of this material.—*Engineer of Motive Power and Equipment.*

THE READER'S PAGE

64 Volts For Passenger Cars

To THE EDITOR:

Your editorial in the May issue on "110 Volts for Passenger Cars" contains a number of claims, some direct and some implied, which I believe are misleading. If a review of the car lighting systems available and their possibilities for the future were intended, with this system recommended as the best, a number of important items were certainly overlooked.

It is stated that cars equipped with the 110-volt system do not require charging at Jacksonville Terminal, with the inference that that system is responsible for the elimination of yard charging there. Yard charging requirements depend on the size of battery and generator and the kind of run. There are certain kinds of runs in which it is impossible to keep a car charged with any axle driven generator system, because the car is not in motion enough of the time. It is quite likely that these particular 110-volt cars have ample size batteries and generators, and their runs are such that they have sufficient time in which to charge the batteries.

The statement is made that 110-volt incandescent lamps are available everywhere and at a lower cost than 32-volt lamps. (Due to W.P.B. orders these voltages are now 115 and 30 volts). However, no mention is made of the fact that a 115-volt lamp has only 79 per cent of the lumen output of a 30-volt lamp (40-watt size), nor that its filament is more fragile. Furthermore any lamp of a household voltage is likely to be stolen, particularly if installed in open-mouthed fixtures. The resulting increased lamp consumption might largely, if not entirely, offset the lower cost.

The statement is made that wayside a.c. power (presumably 110 volts) can be used for lighting cars while standing. I question the implication that 110 volts a.c. is available everywhere. It is not in many railroad yards at present, at least not in sufficient capacity to supply the lamp load on any great number of modern cars. The power supply that is being adopted as a standard wayside a.c. supply is 220 volts, 3-phase, and this soon will be available nearly everywhere that cars are laid up. Cars equipped with Genemotors designed for operation from this supply will become more frequent in the future and on such cars the lamp voltage can be any desired value.

I question the statement that a large number of battery cells with a small number of plates in parallel will give better performance than fewer cells with a larger number of plates in parallel. Ordinarily the fewer the cells in the battery the better, *from the standpoint of the battery only*. The batteries for the 110-volt system cost more, weigh more and the cost of flushing and the liability of damage due to missing a cell when flushing is much greater with a total of 56 cells than with 16 cells. The Proceedings of the A.R.E.E. October 27-29, 1936, page 115, discuss quite thoroughly the relative merits of the three voltages 32, 64 and 110 volts, and give comparative battery statistics.

The present widespread adoption of 32-cell starting and lighting batteries on Diesel-electric locomotives in place of the 56-cell batteries originally used aso points to the desirability of keeping the number of cells to the minimum consistent with all the conditions to be met.

The main reason for the adoption of a voltage higher than 32 on cars is that the cables (and motor commutators) are too large when 32 volts is used with electro-mechanical air conditioning equipment. Also, two-cell units of a battery of 1,000-1,200-amp.-hr. capacity are too heavy for two men to handle easily. The use of 32 cells reduces the weight of a two-cell unit to approximately 250 lb. maximum, which two men can handle reasonably well. A greater number of cells increases the cost and weight of the battery without a commensurate gain in ease of handling the individual units. The reduction in the size of wiring in going from 64 volts to 110 volts is not nearly as important as when going from 32 volts to 64 volts.

While fluorescent lamps can be operated without conversion equipment on either 60 or 110 volts d.c., I understand that the Norfolk & Western is no longer operating them on 110 volts d.c. on the one car described in the Railway Electrical Engineer, July, 1940, page 133.

While I agree that the 32-volt system is not desirable for use with electro-mechanical air conditioning equipment, I believe that the 64-volt system using 32 cells of battery should not have been passed over with as little consideration as was done in your editorial.

In my opinion, the 64-volt system is the best all around system for use with electro-mechanical air conditioning and axle driven generators. We now have in service on the New York Central 717 cars with electro-mechanical air conditioning equipped with this system, including 40 cars with 60 volt d.c. fluorescent lighting. Practically all of these cars have 32-cell, 600-amp.-hr. batteries and 20-kw. generators or Genemotors. While I cannot say that they never require yard charging, this occurs very seldom, and when it does, is due primarily to failures of regulating or mechanical equipment, rather than any inability of the generator to keep the battery charged. When this system is used with a 20-kw. Genemotor, thus permitting yard charging from 220-volt, 3-phase a.c. supply lines, it provides as near an ideal system as can be obtained with any arrangement that depends on motion of the car to operate the generator.

Please refer also to my discussion of 32 vs. 64 volt systems in Railway Electrical Engineer, November, 1938, page 237.

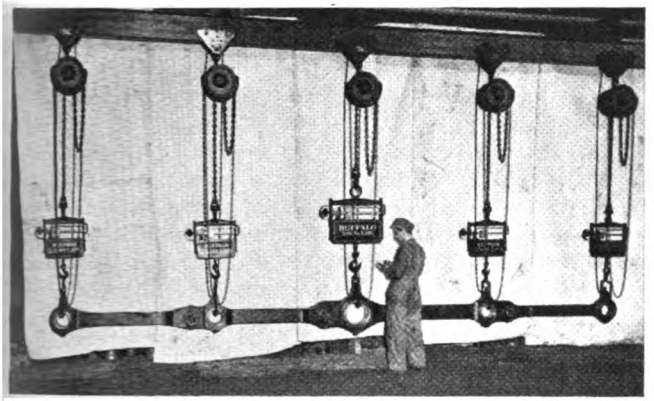
An article comparing the 32-, 64- and 110-volt systems with and without Genemotors, based on present day practice, would be very desirable for reference when we are once more able to undertake improvements on passenger cars.

W. S. H. HAMILTON,
Equipment electrical engineer,
New York Central System,
New York.

IN THE BACK SHOP AND ENGINEHOUSE

Accurate Determination Of Locomotive Counterbalance

The Erie has recently installed in its locomotive shop at Hornell, N. Y., a new unit for determining the exact counterbalancing required on locomotives passing through the shop. The former method of weighing rods required the use of platform scales with the rods supported on V-blocks for leveling. This operation required the use of great care in leveling and results were not always satisfactory; reweighing of the same rods often produced results far different than those obtained in earlier weighings. The time required under the new system is only half that formerly required to weigh each set of rods and the results are much more accurate.



Rod weights are determined with maximum accuracy with this new scale arrangement

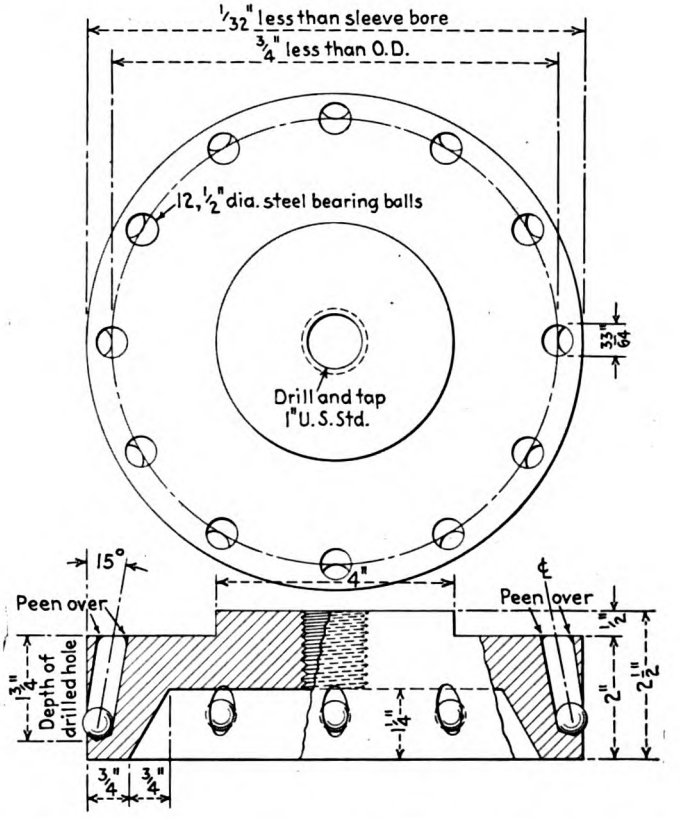
Five Yale trolleys have been mounted on a 12 in. I-beam and from these five Yale chain hoists are suspended. The center hoist is of 5000 lb. capacity, the others are of 2500 lb. capacity. Buffalo scales of the same capacity as the hoists to which they are attached are equipped with hooks which pass through the crank pin bushing holes. The center unit is attached to the middle connection on the rods and the other scales attached at their proper points. The chain hoists are used to level the rods and the scale readings are taken to determine the counterbalancing necessary on the driving wheels. More efficient locomotive performance is resulting from the greater accuracy in determining rod weights.



Chain hoists are used to bring rods to level position for weighing

Cylinder Sleeve Extractor

The extraction of cylinder sleeves, or bushings, from the block of an internal combustion engine equipped with removable sleeves is difficult when the lower end of the sleeve has been broken away or is irregular as a result of a wrist pin, piston or correcting rod failure. Usually no seat is left for conventional type sleeve pullers to act upon.



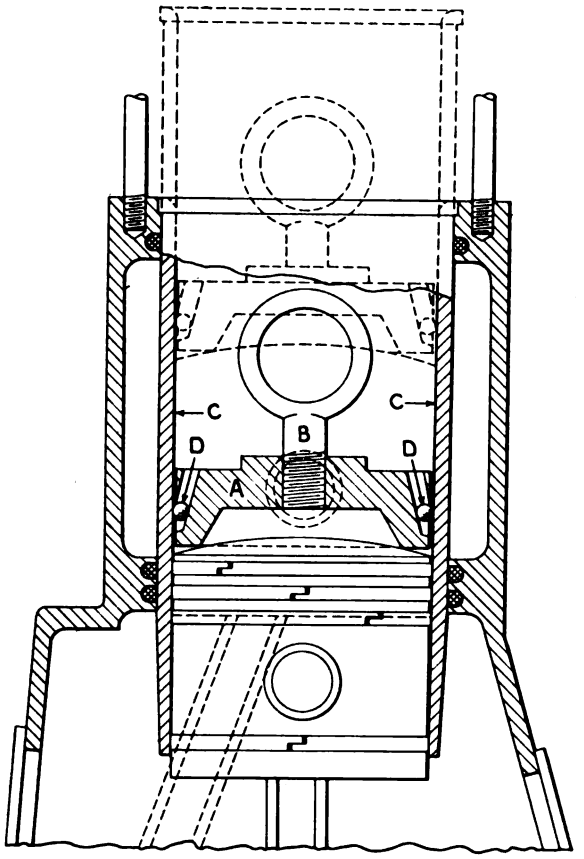
Extractors to remove cylinder sleeves from motor blocks depend upon the gripping action of steel balls against the sleeve walls

Other conditions may also be present to make removal difficult.

A sleeve extractor which will function efficiently can be built in any railroad shop. The stock used should be of a good grade of steel; discs cut transversely from scrap locomotive crank pins or axles make good blanks and

eliminate a forging operation. The upper face of the blank is finished off in a lathe and faced off square. A chucking boss is then machined and, before removing the piece from the first set up, a center hole is drilled in the blank which will tap to a one in. U. S. standard thread. A pitch circle is then scribed on the upper face which is ¼ in. less diametrically than the finished outside dimension of the extractor. The blank is reversed in the chuck and the bottom faced off. This surface may be cupped out to reduce the weight of the tool.

Twelve equally spaced $^{33}/_{64}$ in. holes, centering on the pitch circle, are drilled at an angle of 15 deg. from the vertical, pointing outward from the pitch circle. Each of these holes should be drilled to a depth of 1¼ in. These holes serve as races for ½ in. steel balls which are the gripping elements in the extractor. The outside of the extractor is finished to a diameter $^{1}/_{32}$ in. less than the nominal bore of the sleeve to be extracted. A one in. threaded hole in the center of the disc provides an anchorage for either a one in. eye-bolt or a one in. draw stud.



A—The extractor disc
B—Eye bolt, required if outside force is being applied
C—Sleeve wall
D—Extractor unit balls which are forced against the sleeve wall

In many cases the piston itself can be used to furnish the force required to remove a cylinder bushing

When a sleeve is to be removed the extractor is entered at the top of the sleeve. Each ball recedes into its race as it contacts the sleeve wall and permits the unit to be lowered to the desired location. When an upward pull is applied the disc begins to grip against the sleeve wall as each of the balls is forced against the sleeve. The greater the pull exerted, the greater the pulling action of the balls becomes and the sleeve will finally yield to the upward pull being applied. It is also possible to use the device in a motor from which the piston and connecting rod have not been removed without utilizing the eye-bolt or draw stud. The disc is lowered until it rests upon the piston head. When it is in position the fly wheel of the motor is turned over with a bar which forces the piston upward and, in so doing, tightens the extractor against the sleeve wall.

In employing the latter method care must be taken to position the piston so that the extractor disc does not descend below the upper sleeve seat of the block. This places the crank and connecting rod at the most advantageous leverage position. In addition the block serves as a reinforcement for the thin wall of the sleeve and protects it from distortion from the pressure exerted by the ball.

When sleeves to be removed are still serviceable or can be reclaimed the use of an auxiliary protector ring will protect the sleeve walls from pitting from the pressure of the extractor balls. This arrangement provides only a straight friction grip between the extractor and the sleeve and, for this reason, the extractor should engage below the upper sleeve seat of the block. Otherwise, the slight expansion caused by the action of the extractor might increase the adhesion of the sleeve within the block to such an extent that it would exceed the adhesive strength of the protector ring. The protector ring should be made of bronze and slightly wider than the thickness of the extractor disc. A wall thickness of ¼ in. will be satisfactory. The ring should be split on one side and have an outside diameter which provides a forced fit in the sleeve bore. Its inside diameter must permit the free entrance of the extractor unit.

The extractor requires no adjusting or other attention from the crank case end of the cylinder, it will engage with any sleeve regardless of the condition of the lower end or the wear on the sleeve caused by the piston. It permits the extraction and replacement of serviceable sleeves in cases where the pistons and rings are known to be intact without the necessity of removing these parts from the motor. Application and removal of the unit are simple operations.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Bolt Lugs on Trailer Oil Cellars

Q.—Will you recommend a satisfactory welding procedure for broken bolt lugs on trailer oil cellars?

A.—When a large section of a lug is missing it is quite difficult to rebuild the lug and still maintain the correct size of the hole. In such cases bend a piece of ¼-in. plate of the desired width to reassemble the missing piece. The inside dimension of this piece should be the same as the required inside diameter of the hole. Chip, grind or file the cast-iron cellar part of the lug bright and clean. Place the piece of bent plate in position and tack with bronze. Rebuild the lug to the desired size being certain to get a good bond between the bronze and the cast iron.

Brazing Plugs In Cylinder Saddle Holes

Q.—We are changing a number of front frame sections on some heavy freight power. The bolt holes connecting the frame and cylinder have been reamed so much that the holes are very much oversize. We do not wish to drill such large holes in the new frame. Can we bush or fill these holes?

A.—Steel plugs can be turned to fit the holes and driven into the holes flush with the back side of the casting. The plugs are made about ½ in. shorter than the hole on the frame-fit side. After the plugs are driven into the holes the remaining part of the hole is countersunk with an air hammer and chisel. This gives the welding operator an opportunity to braze the plug to the cylinder.

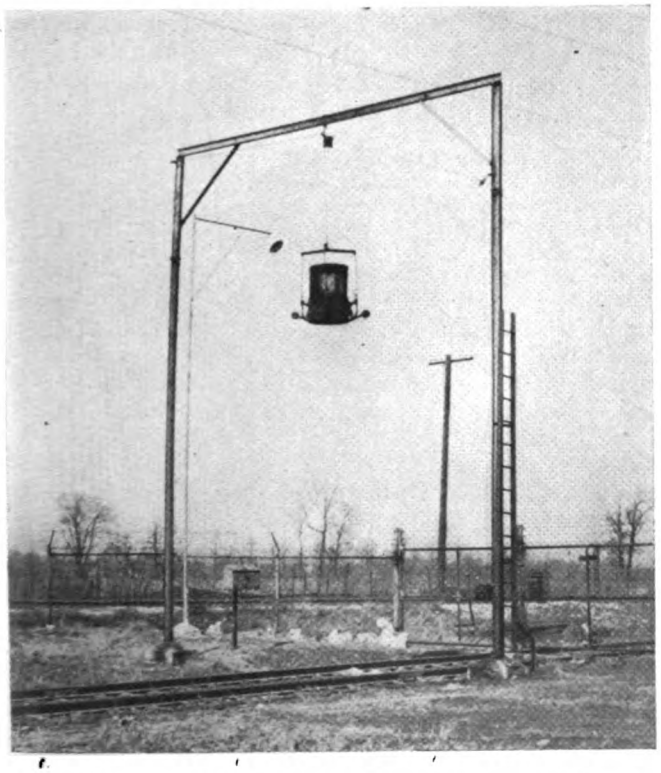
After the brazing operation is completed and while the bronze is still hot, peen the bronze thoroughly with the air hammer and a bobbing pin. Peening will keep the contraction of the applied bronze down to a minimum. The new frame section may now be drilled to standard size and, when placed in position under the cylinder, the holes in the casting can be drilled by following through the holes already in the frame.

Removable Spark Arrester for Locomotives

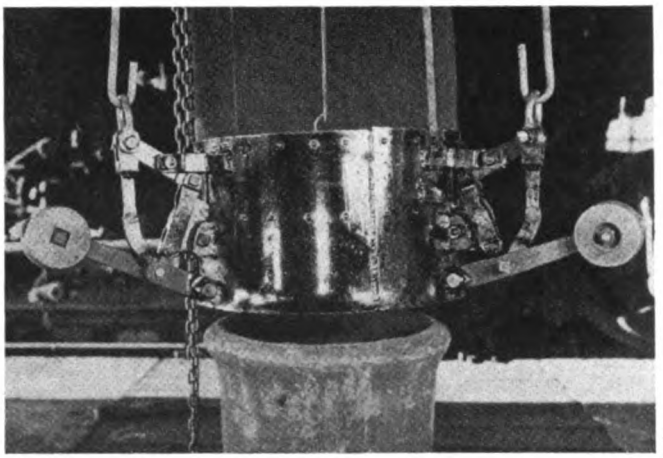
*By S. H. Kahler**

Precautions against fire in industrial plants which might result from the use of coal-burning locomotives in plant properties are especially important in locations where war materials are being produced. A large explosives manufacturer required that a spark arrester of ⅜-in. wire mesh be used on locomotives working on its property. It furnished an arrester which was functionally very effective but which was of a type that fastened to the smoke stack by means of four 1-in. set screws.

* Master mechanic, Toledo Terminal, Toledo, O.



Locomotives are spotted under this frame for the application of the spark arrester



The spark arrester in release position—When applied to the stack the counterweights hold the eccentric locking dogs firmly in position on the bell of the stack

This mode of application required the engine crews to spend a considerable amount of time on top of the hot smoke box while applying and removing the spark arrester by the tightening or loosening of the set screws. In addition there was a personal injury hazard involved. To save crew time and reduce the danger to employees, a fully self-locking semi-automatic spark arrester was designed and built. It has proved successful in operation and conserves man hours while eliminating unpleasant and possibly hazardous working conditions.

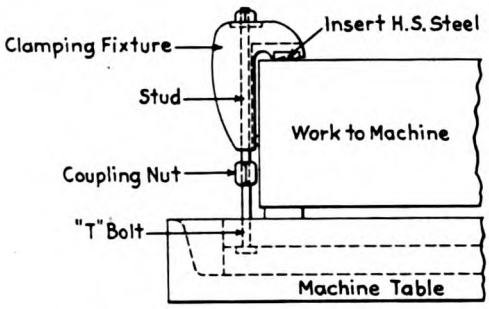
A steel framework was erected on the plant lead track and the arrester is suspended from this framework on a steel cable which runs over several pulleys and is attached to a hand-operated winch on one of the side members of the frame. When a locomotive is spotted under the frame a ladder is placed against the side of the smokebox and the arrester is lowered by operation of the winch to its position on the stack. A crew member releases the clevises on the spark arrester from the hooks on the holder and the dropping of counterweights locks the device in position. The locking feature consists of three dogs made of ¾-in. steel which are connected with levers that engage under the rim of the stack. When the spark arrester is to be removed the clevises on the lever arms are attached to the hooks on the holding device and the spark arrester is raised by the cable and winch to clear the

Positive Clamp Frees Table Space

Clamping work to machine tables by means of U clamps has been changed in some applications as the result of a clamping fixture suggested by an employee at the Schenectady, N. Y. works of the General Electric Company.

The fixture is a positive clamp with an inserted hardened-steel jaw to prevent slipping. A T-bolt is fitted with a coupling nut so that by varying the length of the stud used, the clamp may be employed on varying thicknesses of work. Since but a negligible amount

of space is needed for fitting the T-bolt into the table, its full length can be utilized. Previously, blocks to support the U clamps took up much working space.

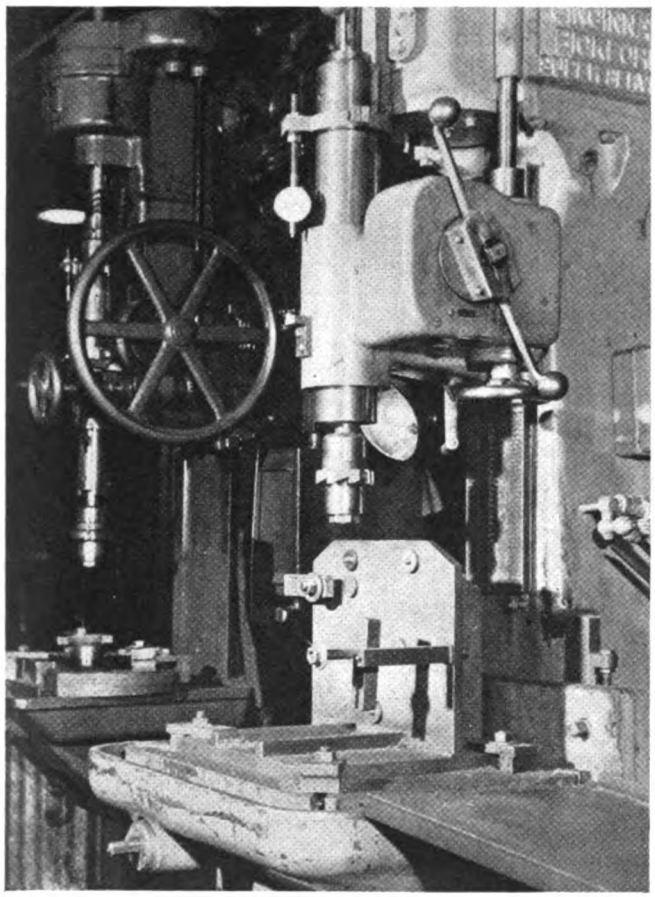


This T-bolt clamp replaces U clamps and frees table space

The clamping fixture is being used successfully on boring mills, planers, anl milling machines.

Close Tolerances In Drill-Press Work

Difficulties in holding the depth tolerances of plus or minus .0015 in. in facing operations on heavy-duty drill presses have been overcome at the Appliance division plant of the Westinghouse Electric and Manufacturing Company, East Springfield, Mass. Normal spring and give in machine and fixture made it impossible to work to the regular spindle stop and maintain the required tolerances. The problem was solved by making a dial indicator attachment mounted on the spindle sleeve. A collar around the spindle sleeve holds a standard .0001-in. dial indicator by means of an adjustable threaded bracket. A stop fixed to the spindle bracket provides the point on which the indicator plunger rests. In operation, the indicator is set to read the last few thousandths of the cut. The spindle is brought down to this point by power feed. The feed is then disengaged and the cut finished by hand feed to the proper depth, as indicated by the dial.



A dial indicator is mounted on a heavy-duty drill spindle, to help hold close depth tolerances

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Bolts for Boiler Patches

Q.—Should the thread on boiler patch bolts be tapered or straight?—J. D.

A.—The threads on boiler patch bolts should be straight. In applying these patch bolts the holes in the patch are made $\frac{1}{32}$ in. to $\frac{1}{16}$ in. larger than the diameter of the patch bolt to be used and the boiler sheet is drilled and tapped for the bolt. By using straight threads in the boiler sheet and the patch bolt, the bolt can be tightened until the patch is drawn down tight against the boiler shell, insuring a properly fitted patch on the boiler. If tapered threads are used it is possible for the patch bolt to become tight in the boiler sheet without having drawn the boiler patch firmly against the boiler.

Preparation of Conical Courses

Q.—After rolling a conical boiler course it is necessary to flatten the ends so that the conical course will fit the adjacent straight courses at the circumferential seams. How is this work done?—M. I. T.

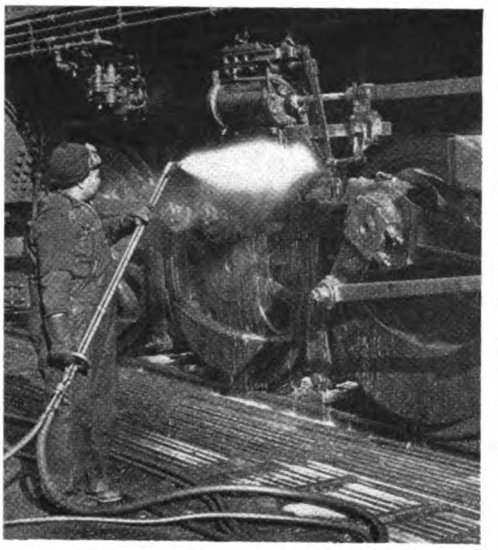
A.—There are two methods of flanging the ends of conical courses to fit the adjacent straight courses at the circumferential seams. The method to be used is determined by the facilities of the shop and the taper of the conical course. Shops equipped with hydraulic riveters can do this work with the riveter, if the conical connection does not have too much taper. The plate is flanged cold with the hydraulic riveter. The riveting dies are replaced with flat dies; the rolled cone is suspended by a crane and pressure is applied around the circumference of the conical section until the desired condition is obtained.

When the taper of the conical section is too great or the flange too long for cold bending, as at the front end of a conical first course where the flange is made long for receiving the front tube sheet, the plate is heated around the end in an open blast fire to a red bending heat. The end is then made cylindrical by pounding it with mauls. The correctness of the flanged diameter is checked by running a measuring wheel around the inside surface of the plate.



Steam-hammer operator, Mrs. Elizabeth Barnes, Southern Pacific, Bayshore, Cal.

Negro woman cleaning locomotive in enginehouse, Illinois Central



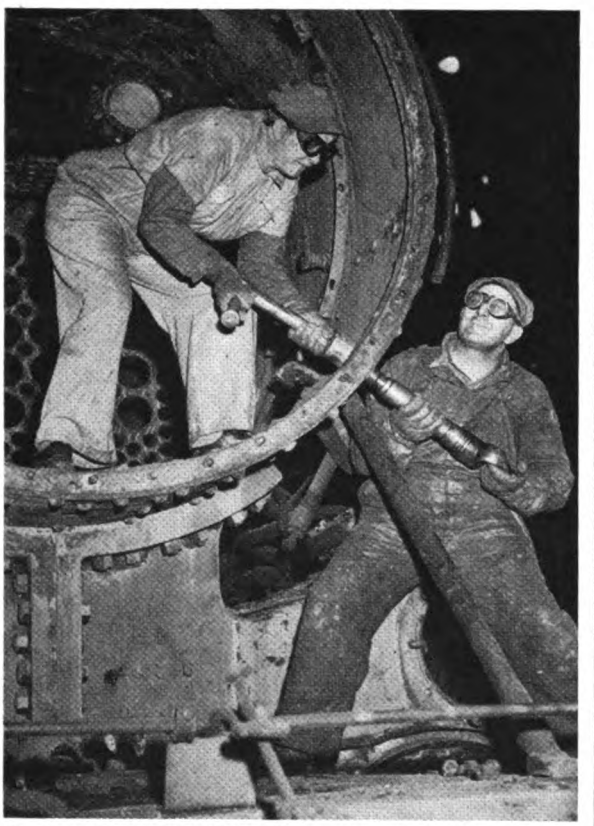


Woman machinist helper, Pennsylvania shops, Wilmington, Del.

Women Workers in the Locomotive Shop

Mrs. Stella Sloop working as a blacksmith helper, Southern Pacific, Portland, Ore.





Credit Pittsburgh Sun-Telegraph

Mrs. Louise Shaw, boilermaker helper, working with her husband, William R. Shaw, Baltimore & Ohio, Glenwood, Pa.—Recently featured in short-wave overseas broadcast

Cutting shears operated by woman tinsmith helper, Pennsylvania, Wilmington, Del.



With the Car Foremen and Inspectors

Wheel Conditions and Wheel Shop Practices*

By M. E. Fitzgerald

On many occasions I have been compelled to take the position that, if the various rules and regulations of the A.A.R. were complied with, a great improvement would be effected in train operation. If the present war has proven anything it has distinctly shown that nations, organizations and even individuals will not conduct themselves in the society of nations under merely a gentlemen's agreement, and it now appears that, unless the committees and officers of the A.A.R. are delegated with definite authority to enforce the rules and regulations of that body, we cannot expect anything like general compliance with their recommendations.

Flagrant violations of rules governing general freight car and wheel conditions have been exposed in committee reports. Referring to the accompanying statement of car detentions during the first 10 months of 1942 on the C. & E. I. your particular attention is called to the figures for hot boxes, which caused about 50 per cent of all delays, most of the hot boxes occurring on foreign and private line cars. A study indicated clearly that unsatisfactory wheel conditions were a contributing factor and we submitted some data to the A.A.R. investigating committee at Chicago, with the result that a committee was appointed to investigate wheel shop practices in and about Chicago.

It was found, for example, that cars of a certain ownership would not operate without serious delays due to hot boxes even though these cars were right out of shop after a repair job costing about $1,000 and each car was newly painted, stenciled and assigned for loading with a high-class commodity.

Investigation indicated that the wheel shop practices of this car owner were decidedly in violation of all generally-accepted rules. We found wheels mounted from 1/8 in. to 5/16 in. out of gage, narrow; one-wear wheels mounted on new axles; wheels condemnable by remount gage on account of high flanges and badly-worn flanges; journals improperly machined; collars on journals 1/16 in. to 1/8 in. too high; journals elongated to the extent that they should have been scrapped; and journals on new axles machined either short or long with bad finish on journals, collars and fillets.

The committee visited one road's wheel shop near Chicago and found conditions such as obsolete machinery; a three-jaw boring mill chuck in such condition as to require the use of liners between the wheel rim and the boring mill dogs, the wheels being bored 1/4 in. eccentric. The tools used on the boring mill and the lathe in no way conformed to A. A. R. Wheel Manual requirements and when used would not produce a reasonably good job. The mounting gage was non-A. A. R. standard, too narrow and not conforming to A. A. R. design. No centering device was used, the wheels being positioned on the axles by measuring from the outer edge of the journal collar rather than from the center of the axle.

This is far from being the only shop in the Chicago territory not conforming to A. A. R. Wheel and Axle Manual requirements. We found many others, including large trunk lines, violating the general provisions of A. A. R. requirements. For example, wheel seats are not being properly machined and in many cases it was found that no attention is being paid to the A. A. R. requirement that wheel seats be turned back 3/8 in. to permit proper measurement behind the wheel hub proper on mounted wheels. We also found journals not being machined where they were tapered and had rough back and front fillets. The facts in this matter are set forth in minutes of the Chicago committee's meeting which are available to all trunk lines in the Chicago territory.

Many Car Wheels Mounted Out of Gage

The committee appointed to investigate wheel shop practices found a number of wheels being mounted out of gage, either due to diagonal bore, eccentric bore, or mounted through the use of worn-out and non-standard mounting gages. A great many of the wheels and axles on hand for use under cars and inspected by this committee should not be permitted to go back into service if we hope to reduce terminal and train delays and the expense incident to wheel and axle defects.

Accuracy of equipment and gages has a major bearing on these practices and this accuracy is largely dependent upon the checking and correcting of the machines and tools in the shop. In connection with lathe and boring mill tools, we found that very few shops are properly equipped to produce proper contour tools. These tools are found to be ground on an emery wheel and put into service. It is the recommendation of the committee that in addition to an emery wheel every shop be provided with a sandstone in water.

In connection with rolls used in rolling journals and fillets, these should be of A. A. R. design and so main-

* Abstract of a paper presented at the May 10 meeting of the Car Foremen's Association of Chicago. Mr. Fitzgerald is master car builder of the C. & E. I. and chairman of the A. A. R. Chicago Wheel Shop Committee.

tained, and it is further the recommendation of the investigating committee that an arrangement be made whereby these rolls can be occasionally burnished to a fine finish, using an endless leather belt driven by a ¼-hp. motor. This committee felt that after a journal and the seat are turned all particles of steel should be carefully washed off to prevent their being rolled into the finished journal. This is not being done.

Each shop should carefully check boring mills and lathes daily to see that they are in condition to perform proper machining.

Axle Lathes Must Be Checked Periodically

The accuracy of the work being done on the axle lathe can be checked by the boring mill operators who should be instructed to report when any taper or out-of-roundness approaches .002 in. and wheels should not be fitted to any axles which have wheel seats that are in excess of .002 in. The bore of a few finished wheels should also be checked daily, with the same limits for correction. This should preferably be done by the wheel shop foreman. The foreman should also make a habit of observing the pressure diagrams, the finish being obtained in the wheel bores and on the axle wheel seats and journals and should make occasional checks on the roundness of axle journals.

Wheels bored eccentric will cause a vertical movement of the journal with each revolution of the wheel, equal to this eccentricity. The result will be damage to the journal bearings, the car truck, the lading in the car, the rail and to the wheel itself. This condition will never improve in service, but, if anything, will get worse.

Wheels bored diagonally will develop uneven flange wear as well as excessive tread wear, thus influencing the performance of the far truck and causing more lateral movement or nosing due to the wheels not running true with the rail. It will also cause increased bending stresses in the car axle, particularly when the wheels are new.

Wheel bores and axle wheel seats which are machined with a taper or out-of-round cause many misfits in the wheel shop, but more serious than this, they are generally the underlying cause of wheels becoming loose in service. They also result in severe stress concentrations which may contribute to, or be the direct cause of, wheel and axle failures.

Accurate machining is as important in finishing axles as in boring wheels. There are three factors to be considered: The accuracy of the machining as it affects the pressure fit between the axle and wheel; the quality of the finished surface as it may affect the formation of fatigue cracks in service; and the quality of the finished surface of the journal as it may affect journal bearing wear and possible hot boxes.

Axle lathes should be capable of performing precision work. Many axle lathes now in service are not rugged enough to turn wheel seats and journals and withstand the heavy pressures necessary properly to roll journals and seats after turning. Some shops have a special machine for rolling the axles at both ends which makes for a more accurate job. The A. A. R. committee should give serious consideration to recommendations providing that the rolling of journals be performed on such machines.

The wheel seat should be concentric with the journal, round and free from taper, within .002 in. The outer ⅜ to ½ in. of the wheel seat should be smoothly tapered approximately 1/32 in. in diameter toward the dust guard seat to aid in starting the wheel straight on the axle without cutting. The journal must be round, having a minimum of taper and rolled to a glass smooth surface.

Use of Micrometer Calipers Recommended

The A. A. R. does not indicate specifically the type of calipers essential for proper measurement of axle and wheel boring operations. This committee investigating shop practices found many shops are using spring calipers and it might be well for the A. A. R. to specify clearly that proper inside and outside micrometer calipers should be used. It is absolutely impossible to get proper measurements using spring-type or even Davis calipers. Outside micrometers should be used in the measurement of wheel seat diameters for the same reason that inside micrometers are required for measuring wheel bores.

There is a tendency in many wheel shops to slight second-hand wheels and axles which are to be remounted. Second-hand wheels should be rebored before being remounted to reduce variables in mounting wheels and eliminate the question of judgment.

It will seldom be necessary to enlarge the original wheel-bore diameter more than 1/32 in. unless it is eccentric with the tread. Where this latter condition is found, shims should never be used to center the old bore under the boring bar. If the bore would otherwise have to be made greater than the maximum, the wheel should be scrapped.

The ideal condition would be to also re-turn all second-hand axles before wheels are again mounted on them. This would eliminate the checking to determine the necessity of re-turning.

Journals should never be re-rolled unless a full machine cut has been taken over the old surface. Attempting to remove imperfections by re-rolling will almost surely cause minute cracks in the hardened surface which may result in trouble later on.

Where it has been decided that re-turning is to be done only on axles which are not perfect, a definite procedure

Analysis of Freight Car Detentions on the C. & E. I. During the First Ten Months of 1942

Cause of delay	System			Foreign			Private Lines			All		
	Number of cars	Time, hr.	— min.	Number of cars	Time, hr.	— min.	Number of cars	Time, hr.	— min.	cars	Time, hr.	— min.
Hot box, set out	68	20	20	299	85	27	132	34	47	499	140	34
Hot box, set out	11	2	19	20	3	12	26	4	59	57	10	30
Sticking brakes	33	5	45	54	12	55	63	12	14	150	30	54
Defective knuckle	11	3	43	21	6	39	33	16	54	65	27	16
Defective train line	4	2	15	7	1	36	24	6	43	35	10	34
Defective drawbar	7	5	20	13	7	30	60	50	41	80	63	31
Defective break beam, etc.	10	2	12	48	14	15	29	10	24	87	26	51
Miscellaneous	6	2	15	10	2	28	10	2	42	26	7	25
Defective air hose	4	..	58	11	2	13	4	..	58	19	4	9
Train parted	9	2	5	8	1	58	15	2	38	32	6	41
Leaking	0	..	0	2	..	27	3	..	47	5	1	14
Load shifted	0	..	0	8	1	54	0	..	0	8	1	54
Close door	0	..	0	1	..	10	0	..	0	1	..	10
Off center	1	1	40	0	..	0	0	..	0	1	1	40
Total	164	48	52	502	140	44	399	143	47	1065	333	23

for checking all second-hand axles should be adopted. The wheel seat should not be tapered or out-of-round more than .002 in. as determined by means of outside micrometers; the surface should not show evidence of an uneven bearing from the previous wheel; it should not show evidence of previous machining with a sharp-nose tool, or a feed in excess of 1/16 in.; there should be no gouges or scratches on the surface; the journal should be round and free from taper; the surface should be smooth, with no rust pits, dents from handling or any evidence of over-heating in service.

In cases where either the journal or wheel seat is to be re-turned, it is advisable to re-machine the other surface as well. If this is not done, there is almost sure to be some eccentricity between these two portions of the axle. It is also preferable, for the same reason, to make the finish cuts on both surfaces without changing the set-up in the lathe. Eccentricity between these surfaces will result in the same objectionable reactions that come from a wheel being bored off center.

Do Not Slight the Second-Hand Axles

The turning of second-hand axles should be done with the same accuracy as new axles. Too much care cannot be exercised, particularly in the fillets. Any sharp or ragged tool marks in these areas of stress concentration can, and often do, form the start of fatigue cracks which may progress to the point of an axle failure and an accident in service.

The use of a journal-truing lathe, or a combination lathe for axle machine work with or without the wheels on the axle, is highly desirable where cut journals in any quantity are re-conditioned. This will permit the refinishing of journals without removing the wheels and will thus greatly reduce the number of second-hand wheels to be refitted. In order to reduce, as far as possible, eccentricity between the newly-finished journal and the wheel seat, the centers of these lathes must be maintained in perfect condition.

A condition frequently arises where mounted wheels and axles are removed from service, generally from cars being scrapped, and re-applied under other cars. These wheels are normally examined for defects and journals frequently re-machined. In addition, they should be checked for axle spacing.

It is recommended that the gage of these wheels be checked in the same manner as second-hand wheels which are being remounted on axles. This should include measurements from the ends of the axle for central spacing of the wheels, and the application of the second-hand wheel mounting gage at three or four points around the wheels to be sure that they are to gage and that the axle has not been bent. Wheel sticks should never be used on axle journals in handling mounted wheels, regardless of the protection on the journals.

The A. A. R. has not yet provided a proper mounting gage for use in connection with the mounting of second-hand wheels. The question is being given consideration as a result of recommendations of the Chicago Wheel Shop Committee, and we hope soon to have provided through the A. A. R. Wheel committee a serviceable second-hand wheel mounting gage. Until such time as that type of gage is provided, this committee would like to suggest that the standard gage have the top opening at the apex of the flange proper blocked off, using a 3/8-in. filler block.

Wheels mated on the same axle are required to be of the same tape size. This limits the difference in circumference of mated wheels to 1/16 in. The gaging of second-hand wheels presents a different condition than is encountered with new wheels in that the flanges and treads will have more or less wear. There are three common methods of gaging these wheels on the axles. The preferred method is to use a standard check gage blocked in the opening so that contact is made on the apex of flange instead of on the tread surface.

Recommendations for Submission to the A.A.R.

I should like to recommend that the following be submitted to the A. A. R. Wheel committee for consideration: The wheel seats and journals of all second-hand dismounted axles should be remachined; when a pair of wheels is removed from a car on account of one journal being out, both journals should be remachined, thus eliminating eccentricity; all second-hand wheels should be bored to fit axles; all second-hand pairs of mounted wheels should be gaged with the mounting gage and the spacing of the wheels on axles should be checked before they are applied under cars; rules covering the permissible limits of eccentric and diagonal bores of second-hand mounted wheels should be adopted; a rule covering all misgaged mounted wheels should be adopted; the limit of taper and out-of-round for journals should be specified as a rule; all burrs and sharp corners should be removed from dust collars, end collars and center holes at ends of axle; wheel sticks should not be used on journals or end collars; accurate micrometer calipers should be specified for fitting wheels to axles.

A. A. R. Mechanical Division Releases

Since the last issue of *Railway Mechanical Engineer*, the Association of American Railroads, Mechanical division, has issued a number of circular letters having an important bearing on car department matters and these letters are included, in full or in part, below.

The Sixth Progress Report covering passenger car axle tests with 5½-in. by 10-in. journals, dated October, 1942, has been completed and is now ready for distribution to members of the division at a cost of $4.00 per copy and to other than members at a cost of $8.00 per copy. A small supply of earlier Progress Reports is also available.

Specifications

The Committee on Specifications for Materials has authorized an editorial addition to Table II, page 9, of Specification M-101 by inclusion of the Class F axle, as follows: Class F axle; size of journal, 6½ in. by 12 in.; smooth-forged with rough-turned journal and wheel seats, 1,185 lb; rough-turned all over, 1,200 lb. This will be included in the next revised pages of the A.A.R. Manual.

In response to a demand for revision of Specification M-502 covering relined journal bearings, to provide for relining the present standard emergency bearing, the Committee on Journal Bearing Development with the cooperation of the Committee on Specifications for Materials has approved a revision covering the relining of both the A.A.R. Pre-War and Emergency journal bearings, harmonizing as far as practical, crown and lining thicknesses in the interest of conservation of critical and scarce materials. This revision was issued in the last set of revised pages in March-1943 as Specification EM-502-42 and fully covers the general relining practice which should be followed.

'ar Wheel Designating Letters Must Be Shown

Effective January 1, 1942, Specification M-403 covering ast-iron wheels was modified to eliminate the purchaser's itials and, in lieu thereof, the manufacturer is now re-uired to number his wheels consecutively, using a letter refix to indicate the plant designation. Difficulties are eing experienced with respect to identification of failed heels from evidence appearing on A.A.R. billing repair ards, due to the fact the letter preceding the serial number not shown.

It should be understood that the designating letter is ntended to become a part of the serial number and should ppear on all wheel records. Car department supervisors re requested to see that this essential information is ecorded on wheel records and billing repair cards.

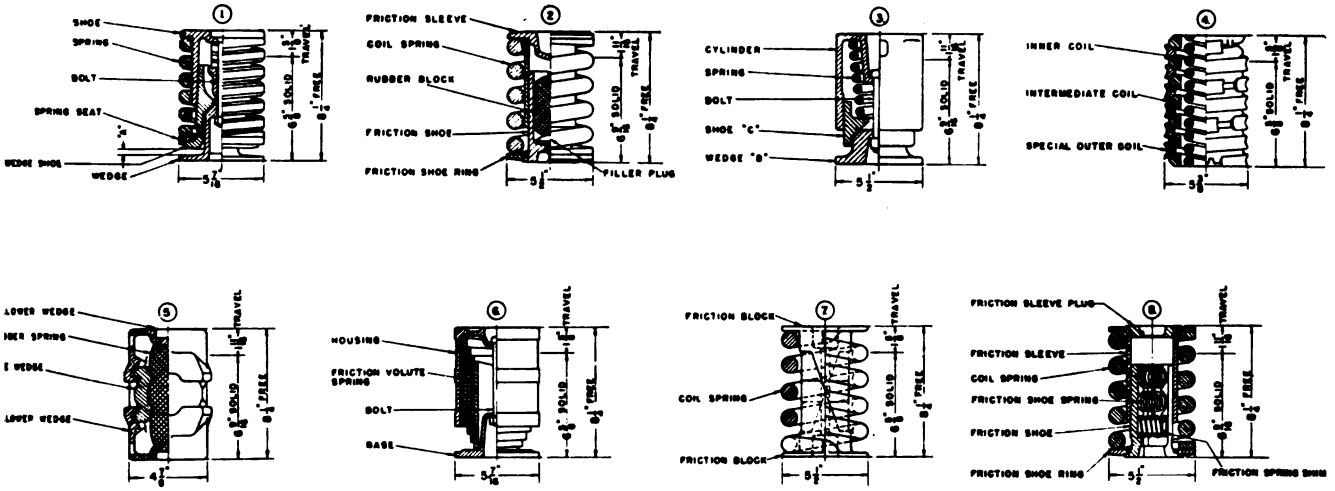
Tank Car Lettering Illegible

Numerous complaints are being received calling attention to the fact that essential lettering on tank cars, ncluding reporting marks and car numbers, is being bliterated by oil and dirt. It is essential that this ettering be kept legible for the benefit of railroad and efinery employees in order to avoid errors in billing, etc.

In cases where it is necessary to renew stenciling, Items 239-241, inclusive, of Interchange Rule 107, provide allowances for renewing this stenciling to preserve the dentity of cars. In the case of tank cars, all that is required in many cases is to wash the accumulation of oil nd dirt from this essential lettering. All car owners nd lessees are urged to institute a program of cleaning heir cars when the lettering has been obscured in this manner and where this lettering is worn badly and still difficult to read, it should be renewed.

Applying Snubber Springs

Because of complaints received from tank car owners that snubber springs were being applied upside down and in the wrong locations in spring nests, the A. A. R. Mechanical Division on May 15 issued standard instructions to be followed by all roads when applying snubber springs. Application prints used by the Union Tank Car Company were used to show the proper methods of application and maintenance of the various snubbers.



—Cardwell Type A—This snubber consists of a coil spring, spring seat, hoe, wedge, wedge shoe and a bolt tying the entire unit together. To de-rmine if the snubber has full capacity or replacement of parts are neces-ry measure the distance *A* between lower shoe and wedge flange. If this imension is 1/32 in. or less the friction parts in the snubber have worn nd repairs are necessary. The snubber must be applied with marking this end up" at top.

—Symington-Gould SBR—This snubber consists of a coil spring, filler lug, rubber block, friction sleeve, friction shoe and shoe ring, held together y a radial pressure of 250 lb. per sq. in. on rubber block. If there is ound a looseness of shoes in the sleeve this will indicate the friction parts n the snubber have worn and repairs are necessary. The snubber must be pplied with marking "this end up" at top.

—Miner C-2XB—This snubber consists of a coil spring, wedge, three hoes and a cylinder all tied together by a bolt. In case of spring failure, he friction elements consisting of wedge *B* and three shoes *C* would be-ome loose and repairs are necessary. The snubber must be applied with edge *B* at bottom and with marking "top" at top.

—Frost 360—This snubber consists of a standard A.A.R. inner coil, one iece special intermediate coil and three-piece special outer coil. As long s the three-piece outer coil is tight upon the intermediate coil with the pring in the car under light weight, or any load, the snubber is still func-oning. This snubber is symmetrical and may be applied with either end p.

5—American Steel Foundries Simplex Unit—This snubber consists of two interchangeable follower wedges, two side wedges and rubber spring. Snubber is held together by uniformly distributed pressure created by rubber spring and interlocking of side and follower wedges. When the ends of the follower wedge wearing surfaces are worn to a knife edge it will indicate the friction parts in the snubber have worn and repairs are necessary. This snubber is symmetrical and may be applied with either end up.

6—Holland A-6—This snubber consists of one working part, a friction volute spring which can be inspected without dismantling the unit. The housing and base which constitute the remaining parts are primarily spring seats for the friction volute spring, a bolt tying the entire unit together. When the volute spring is broken or when snubber appears to be loose in the spring group because of insufficient free height, repairs are necessary. The snubber must be applied with marking "this end up" at top.

7—Gustin-Bacon A-1—This snubber consists of one coil spring and two identical forgings or friction blocks. When the spring or either forging is broken or when the spring has taken excessive set, repairs are necessary. This snubber is symmetrical and may be applied with either end up.

8—Symington-Gould SBS—This snubber consists of a coil spring, friction sleeve, friction sleeve plug, friction shoe ring, three friction shoes, three friction shoe springs and three friction spring shims. If there is found a looseness of shoes in the sleeve, this will indicate the friction shoes in the snubber are worn or friction springs defective and repairs are necessary. Snubber must be applied with marking "this end up" at top.

Various snubber designs involve differences in application and repair

The required locations for snubbers were identified as the outside right corner on trucks with four spring clusters to the group, center of the cluster on five-spring nests, and outside on the center line of the truck in six-spring nests.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

186—*Q.—Describe the operation when the speed exceeds approximately 69 m. p. h.* A.—When the speed exceeds approximately 69 m. p. h., there is sufficient voltage developed in the generator to cause relay *2-H* to assume the energized position. The closing of contact *2-HA* completes the circuit from register *9* through the

lower coil of relay *L* and contact *2-HA* to the negative side of the battery. Thus relay *6* again assumes the energized position. Contact *6-E* being closed, battery current will flow through contacts *6-ME* to *6-E* to the high-speed magnet *H* of the *FS-1864* relay valve. With both the medium and high-speed magnets of the *FS-1864* relay valve thus energized, 100 per cent maximum braking force is developed. Induced voltage in the upper coil of relay *6* assists in positively closing the contact of relay *2-H* as described previously. The transfer contact *6-MA* has now functioned to insure that the induced voltages from relay *6* will now act on relay *2-H* rather than on relay *2-L* as occurred at the lower speed.

187—*Q.—What happens when running at high speed and a brake application reduces the speed below 65 m. p. h.?* A.—The reduced current flowing through the coil of relay *2-H* causes it to assume the de-energized position, thus opening contact *2-HA*. This de-energizes relay *6*, thus opening contact *6-E* and de-energizing the high-speed magnet *H* of the *FS-1864* relay valve. Thus only the medium speed magnet *M* is energized and 80 per cent maximum braking force is developed.

188—*Q.—Describe the action when the speed reduces to approximately 40 m. p. h.* A.—Relay *2-M* becomes de-energized, its contact *2-MA* opening the circuit of relay *6-M*, which relay in turn becomes de-energized and the opening of contact *6-ME* de-energizes the medium speed magnet *M*, thus developing 60 percent maximum braking force.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Railroad Initials Not Basis For Claim of Wrong Wheels Applied

On December 13, 1939, the Railway Express Agency submitted to the Atlantic Coast Line a joint inspection certificate dated July 31, 1939, covering wrong size wheels bearing A. C. L. markings found under R. E. X. car No. 141 for which no billing repair card had been received. Second-hand multiple-wear wrought-steel wheels of 36 in. diameter had been found under the car instead of 33-in. wheels which were standard. Joint evidence of wrong repairs was taken on July 19, 1939, and a check of the Express Agency's records and billing repair cards failed to disclose anything covering the application of the wheels in question. The last record of application of wheels in the particular location was one of April 13, 1938, showing the application of new 33-in. wheels by another road. The contention of the Express Agency was that, inasmuch as the car had been in service on two separate occasions on the A. C. L. and no other railroads or terminal companies which had had the car in their possession between April 13, 1938, and July 5, 1939, had any record of the wheel exchange, the wheels must have been applied by the A. C. L. Reimbursement was also claimed for the difference in value between the wheels removed and those applied. The A. C. L. returned the joint inspection certificate, claiming no record and further disclaimed any responsibility unless the Railway Express Agency could produce an A. C. L. billing repair card. Since no such card was produced the A. C. L. cited Rule 13 and also claimed that its position was in accord with the decisions rendered in Cases 1178 and 1244.

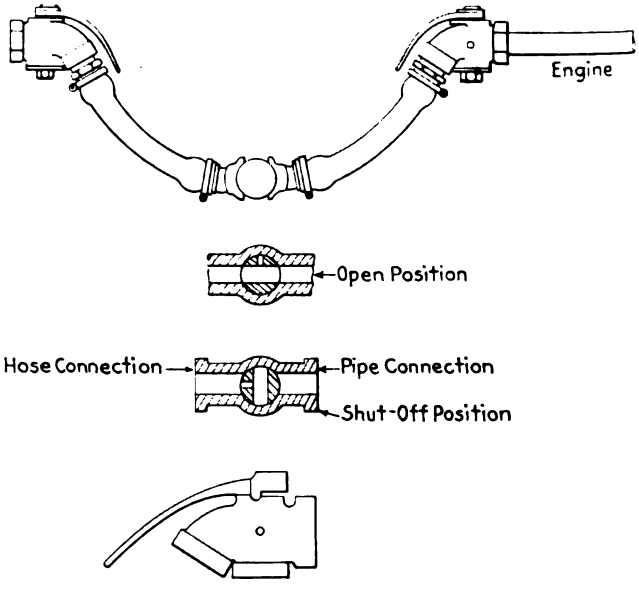
In a decision rendered November 6, 1941, the Arbitration Committee ruled that: "A thorough investigation on the Atlantic Coast Line failed to disclose the wheels involved were applied to R. E. X. Car 141 on that line; neither has the car owner furnished proof the wheels involved were applied by the Atlantic Coast Line. Railroad initials being on wheels, especially second hand, cannot be accepted as evidence the wheels were applied by such road. Therefore, the contention of the car owner is not sustained. Cases 1129, 1178 and 1244 are parallel in principle."—*Case No. 1786, Railway Express Agency, Inc. versus Atlantic Coast Line.*

Bleeding Hose When Uncoupling Locomotives

By P. J. Hogan*

Angle cocks modified by the drilling of a small port in the angle cock body permit the bleeding of air hose before engines are uncoupled from a charged car. Air pressure in the hose is relieved even though angle cocks on the locomotive and car are closed.

At the present time air hose are usually separated under pressure by car inspectors or engine crew members. This causes a strain and, in many cases, the



Pressure in air hose is relieved by the use of a modified angle cock

man performing the operation hasn't the necessary strength or knack for uncoupling the hose and allows them to pull apart with the pressure in them. The modification suggested pays dividends in the elimination of ruptured hose losses, leaking or broken brake pipes and occasional personal injuries.

*Supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.



Mrs. Pauline Schafer packs journal boxes in Southern Pacific yard at Portland Ore.

Women Workers in the Car Department



▲

Mrs. Hazel Edenbrandt operating nut-tapping machine in Southern Pacific shop at Portland, Ore.

Miss Julia Orosz keeps fiery rivets flying for two or three teams of riveters at Glenwood, Pa., shops of the Baltimore & Ohio

▼

P-G photo by Klingensmith





▲

Operating a pipe-threading machine in the shops of the Pennsylvania at Wilmington, Del.

ELECTRICAL SECTION . .

Vitamins For Diesel Power

Part I

By Walter H. Smith* and A. H. Candee*

Comparison of several types of control used to obtain best engine performance

THE purchase of Diesel motive power by the railroads of America has been limited to some extent by two factors—a rather definite maximum horsepower output from any specific engine and a relatively high investment expense per horsepower delivered at the rims of the driving wheels. These two factors are of special importance when the characteristics of steam and Diesel motive power are compared, since the steam locomotive is usually somewhat lower in first cost, has a relatively high power output over a fairly wide range of operating speed, and has some short-time overload capacity provided by the stored heat in the steam generating system. It becomes important, therefore, for the designer and manufacturer of Diesel motive power to insure the greatest utilization of the potential power capacity of each Diesel engine.

An internal combustion engine has a definite maximum horsepower output, and the need for automatic limitation of the engine loading to that available was recognized early in the development of automotive railroad power. Systems of control which relied upon the engineman's judgment to utilize the engine's full output most effectively without exceeding the engine's capabilities were found to be unsatisfactory. This still applies to motive power with mechanical systems of transmission (change gears and clutches) where mishandling can easily place severe stresses on, and seriously increase the repair expense of the engine and the drive equipment. The success of the Diesel engine for modern railroad motive power has been due, to a great extent, to the application of automatic load limiting characteristics built into the transmission system.

Electrical drive has proved, so far, to be the most practical method of transmitting the power from a Diesel engine to the drive wheels of a locomotive or railcar. For this reason, most of the Diesel motive power units employ this system, and since one of the component units of such a drive is an electrical generator driven by the engine, the designing engineer has an excellent opportunity to control the engine loading by automatic regulation of the generator voltage. The need for load limitation is because when an internal combustion engine is operated beyond conservative limits of speed or power trouble inevitably results or maintenance expense is unreasonably high. The use of *automatic* load control arises from the necessity of relieving the engineman of responsibility for the correct engine loading, so that he may direct his attention to the more important duties of train movement.

Full power of a Diesel engine is normally obtained with the engine operating at its full speed, both the full operating speed and the maximum continuous power output being set by the designer in accordance with conservative results obtained from actual operation.

* Both Mr. Smith and Mr. Candee hold the position of transportation engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

However, this engine power, converted into electric energy by a generator, may be utilized at various com binations of voltage and current. As an example this, take the case of a Diesel engine delivering its fu output of 1,000 horsepower for the operation of switching locomotive. Since some power must be uti ized for driving such auxiliary devices on the loc motive as air compressors and cooling fans (usuall about 50 to 80 hp. maximum), assume that only 9 hp. will be available for conversion by the main ge erator into propulsion power. Expressing this hors power in electrical terms (1 hp. = 746 watts), 920 h is 686,320 watts. Since one watt is one volt multiplie by one ampere, this power may be expressed as 1,0 volts and 686 amperes, 900 volts and 762 amperes, an so on down to 200 volts and 3,431 amperes. The fu available engine power (920 hp.) then, may be plo ted in electrical terms as shown by curve *A* of Fig. Now, since there is some slight loss in this conversi from mechanical to electrical power, the horsepow which may be taken out of the generator is slight less than 920 hp. and is in accordance with curve of Fig. 1. The reason that it is necessary to vary t voltage and current at which this electrical power utilized is to obtain variable speed-tractive force cha acteristics, since train speed tends to vary in accor ance with the voltage applied to the traction motors ar tractive force varies with the current flowing throu the motors. Three relative speed points are show on the curve.

Curve *B* of Fig. 1 indicates the generator output vo ampere relation which must be maintained if t Diesel engine is to be kept fully loaded and not overloaded. While such a characteristic c be secured in locomotive operation by manual adjusting the generator field strength (thus varyi the voltage) in accordance with the output curre variation, this entails far too much attention by t engineer and the obvious solution is to include se regulating features in the generating equipment to pr duce this form of curve.

One of the earliest attempts to minimize the ov loading of an internal combustion engine as appli for rail propulsion purposes was the use of a differen ially connected series field (a reversed field which ca

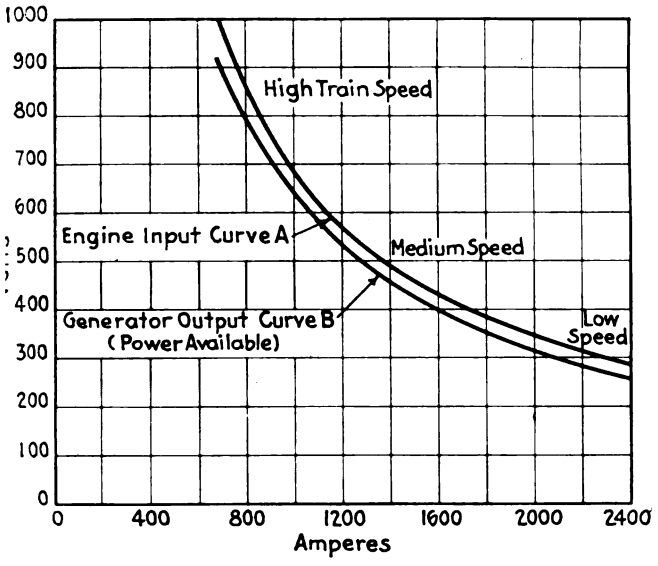


Fig. 1—Volt-ampere variation for constant horsepower—Engine hp. 920

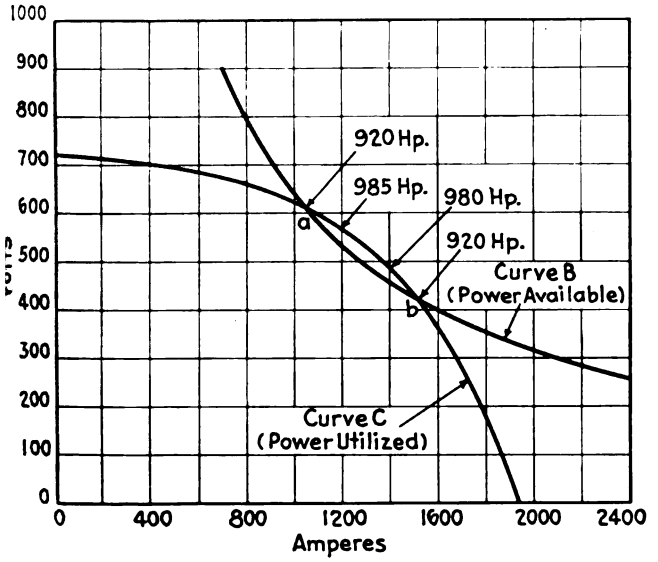


Fig. 2—Early version of automatic regulation

ries the output current) wound into a gas-electric rail-car generator. While the characteristics of such a device were far from being ideal, it gave recognition to the need for automatic limitation of the power which could be demanded from the engine. The shape of the output curve with such a differential series field was entirely wrong, since the curve was convex (bending outward), whereas curve *B* of Fig. 1 shows clearly that a concave curve (bending inward) is necessary. Curve *C* of Fig. 2 shows the approximate volt-ampere output of a generator with a normal (differentially wound) series field, the portion of this curve between *a* and *b* representing the zone where the generator will attempt to take more power than the engine can deliver (which results in over-loading and pulling down its speed). The engine is underloaded elsewhere along this curve.

In 1925 a fundamental development occurred which has had a great influence on the success of gasoline and Diesel-electric motive power. This was the differential field exciter devised by Westinghouse,* wherein the differential field carrying the generator output current was transferred from the main generator to the exciting machine and the exciter output characteristic curve was made concave. With such an exciter characteristic curve the main generator curve was also concave, which conforms much more closely to the desired values. The inherent output characteristic of a main generator when excited by the modern version of such an exciter is shown by curve *D* of Fig. 3. The simple electrical connections for this differential exciter method of control are shown schematically by Fig. 4.

A differential series field winding, carrying main generator output current, normally causes a convex generator voltage characteristic when applied to either

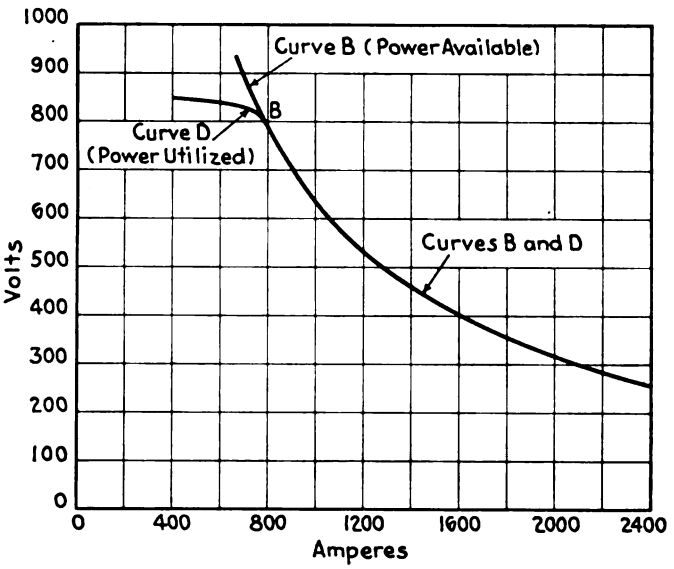


Fig. 3—Main generator characteristic with modern differential field control

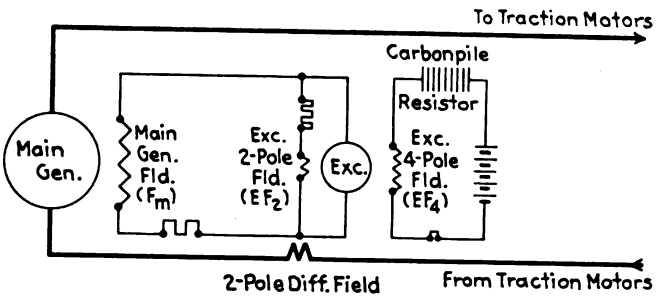


Fig. 4—Schematic wiring diagram for differential field control

the main generator or to its exciter, as shown by curve *C* of Fig. 2. The unique feature of the differential control exciter is the method of generating a concave curve by means of the series differential field action. This result is accomplished by generating cumulative or opposing voltages in the exciter armature conductors by means of two separate groups of field poles. Both the original Westinghouse exciter (Patent 1,730,340) and the modern machine are of six-pole construction, four poles of which are battery excited and generate a relatively constant voltage, to which is added or subtracted the voltage generated by the two additional poles, each carrying self-excited windings (in the latest designs) and differential field coils. These latter poles have reduced cross sections so that they will saturate magnetically.

Fig. 5 shows the arrangement of exciter windings. If the voltage generated in the armature by field poles No. 1, No. 2, No. 4, and No. 5 is considered alone, this is approximately a straight line, as long as the

* See original Gerald F. Smith patent No. 1,730,340 and subsequent improvements as shown by patents No. 2,157,869 and No. 2,217,499 assigned to Westinghouse.

engine speed does not change. This is shown by curve *E* of Fig. 6. The voltage generated by the two poles No. 3 and No. 6 varies considerably depending upon

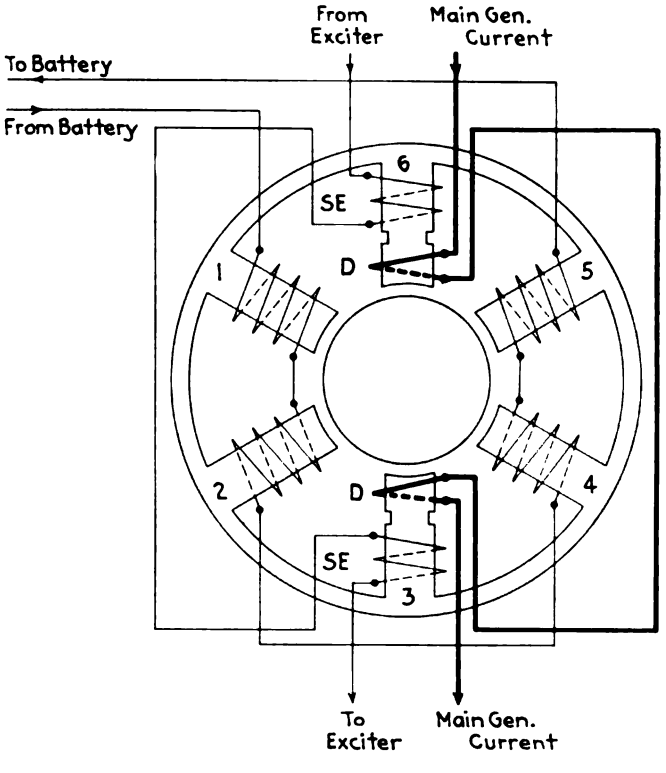


Fig. 5—Differential field exciter circuits

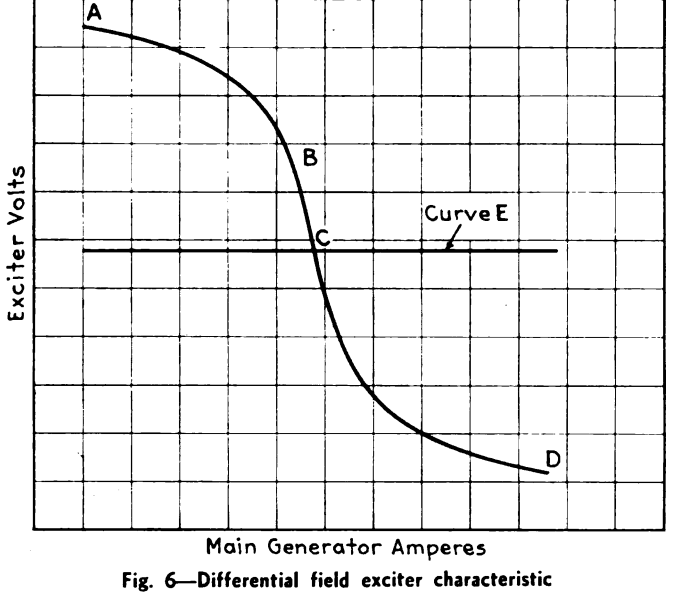


Fig. 6—Differential field exciter characteristic

the relative strengths of the self-excited field and the main circuit differential field. Thus, with no main generator output current flowing through the differential field, all of the voltage generated by the self-excited windings is added to that of the four poles (Nos. 1, 2, 4, and 5) to give a voltage as at *A*. Another point on the resultant curve is *C*, where the differential field and the self-excited field neutralize each other, thus causing the effective voltage to be that of the four poles. Beyond this point, the differential field overcomes the self-excited field and thus subtracts from the four pole voltage, at a *D*. The bending of the curve from *C* to *A* and from *C* to *B* is caused by the magnetic saturation of the two poles No. 3 and No. 6. The net result is that the portion of the curve from *B* to *D* is concave in shape and this characteristic is transmitted from the exciter to the main generator. The sharp knee of the curve shown at *B* in Fig. 3 is obtained by some compounding of the exciter and other design refinements not shown in the simple schematic diagram, Fig. 4.

To those not familiar with the limitations of differential field control, the question may arise as to why it is necessary or desirable further to improve automatic engine loading methods, since this system appears to fulfill the requirements completely in a very simple manner. The characteristic shown by curve *D* of Fig. 3, however, is obtainable only at a definite temperature of the generating units and as the equipment temperature is lowered, the curve rises to try to take more than normal power from the engine. Reference to the diagram (Fig. 4) shows why this is the case. Since the resistance of a field winding gets lower as its temperature goes down, it may be noted that more than normal current will flow from the battery to the exciter field EF_4, which tends to cause higher exciter voltage than normal. This effect becomes cumulative, since the higher exciter voltage and the lower resistance of the self-excited field, EF_2, tends to raise the exciter voltage still higher. Further cumulative effect is noted in the main generator voltage since higher exciter voltage impressed on the cold field of the generator causes considerable excess in main generator field current and thus overvoltage relative to the main current output. Moreover, for any equipment temperature the main generator output characteristic is inflexible, so that even when the temperature is correct to take normal full load from the engine, the speed may be pulled down due to the engine's inability to develop full power from whatever cause, such as dirty injectors, valve leakage, ring leakage, high air temperatures, or elevation above sea level. The reverse is true, of course, and the engine will be underloaded if the electrical equipment is operated at a temperature greater than that for which the loading is set or if the engine has excess power available. Thus, if the differential field controls loading is set to take, say, 920 hp. from an engine (net after auxiliary power is deducted from a 1,000 hp. engine), there is no way to utilize this extra 80 hp. when the auxiliaries are not operating. Since overloading greatly increases engine maintenance expense and underloading is a waste of expensive power equipment, the application of an additional load regulating device is an economic improvement, especially when it is simple and automatic in its operation.

As stated before, the need for close automatic regulation of the power demanded from an engine to conform to its capabilities, has long been recognized and many schemes have been employed to accomplish this result. Among these have been:

Differential field control.

Motor driven faceplate rheostat connected to vary the main generator field strength and actuated by contacts on the engine governor.

Faceplate rheostat actuated by pressure oil from an oil operated governor.

Torque control.

Governor operated gas-filled tubes for field regulation.

Governor responsive carbonpile field regulation.

Autoload control.

It is the latter system which is now providing the vitamins to insure maximum Diesel power utilization without danger of excess maintenance expense.

There are three general qualifications which any automatic engine load regulating system must have if it is to be successful for railroad motive power. These are simplicity; accurate engine loading, and freedom from hunting. With the exception of Autoload control all systems which have been used so far have been imperfect in one or more of the required qualifications. Differential field control has poor loading characteristics. Faceplate control, whether motor or oil driven, is slow in response and normally causes surging or hunting. Torque control results in accurate loading but requires an additional rotating machine (a pilot generator). Other schemes have similar defects.

In designing an effective system of load control for Diesel-electric motive power, it is necessary to start with some engine characteristic which reflects the loading conditions of the engine. One basic function which changes or tends to change as the engine load varies is engine speed, which normally rises as the machine becomes unloaded or falls when overloaded. In torque control, the voltage of the pilot generator varies as the engine speed, and this voltage furnishes the actuating force to govern the regulation. In most of the other systems, including Autoload control, the action of the speed governor is used to indicate engine speed variations which reflect engine load conditions. When an engine becomes overloaded, its speed decreases slightly and the governor tries to give the engine more and more fuel.

Since the maximum has been predetermined, excess governor movement has no effect in increasing the fuel input, but may be used for actuating the electrical regulating system to reduce load. Conversely, as the engine speed tends to rise (thereby indicating engine unloading) the governor acts on the regulating system to build up the load to the maximum possible before the fuel input is reduced. [The Autoload control will be described in the next issue.]

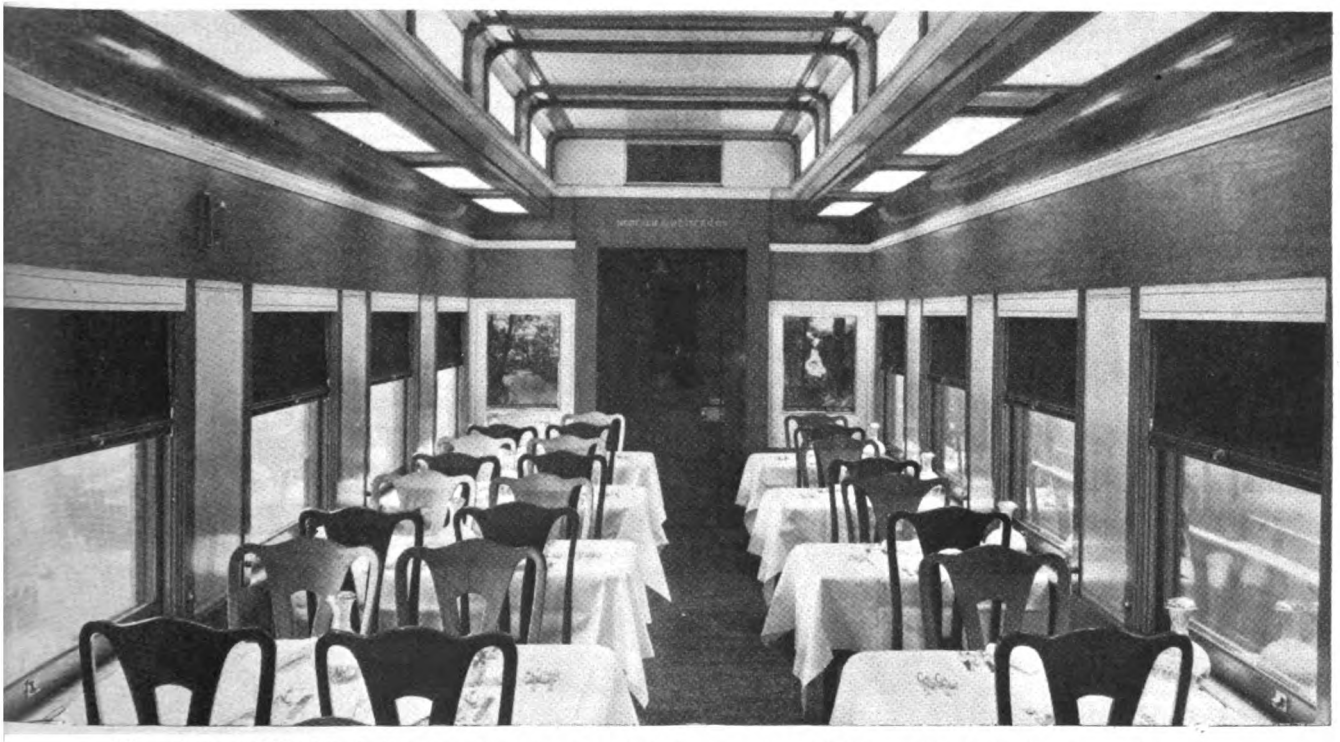
Car Lighting Without Fixtures

When it became necessary recently for the Norfolk & Western to redecorate a number of diners, the lighting fixtures were removed and not replaced. In their stead, frosted glass, replacing wood panels, were placed in the decks and on either side of the clerestory. Behind each of these panels is a 48-in., 40-watt, T-12 fluorescent lamp. There are 20 of these lamps in the dining section. Behind each lamp is a metal white-enameled reflector and the space required by this reflector on the outside of the car on either side of the clerestory is covered by a metal housing. Illumination intensities on the table tops are about 22 foot-candles.

This car is equipped with a 110-volt, d.c. power system including a 20-kw. generator and a 300-amp. hr. storage battery. The type of fluorescent lamps used are normally operated with the necessary auxiliaries from a 220-volt, 60-cycle a.c. power supply, but in this case they are operated ten in series from a 5,000-volt (open-circuit), power source.

The high-voltage power for the fluorescent lamp is obtained by means of a 1.5-kw. booster-type rotary converter. This machine was originally made to supply power to Syntron hammers and has a special winding which causes the a.c. output voltage to be 110, the same as the input voltage. Thus, having 110-volt, a.c. power available, it was possible to install a standard 360-milliampere, sign-lighting transformer to supply the necessary high voltage for operating the lamps ten in series cold cathode. The normal current rating for the lamps is 420 milliamperes, so that the lamps operate slightly below their rated capacity.

An interesting point in the operation of the lamps is that they all light instantly when power is connected to the d.c. end of the converter. In other words, the lamps light at zero frequency but do not go out again since the speed of the converter rises rapidly to its normal 60 cycles at full speed.



The redecorated Norfolk & Western diners have frosted glass panels lighted by cold-cathode fluorescent lamps

Four Ways To Conserve Cable

*By George M. Rogers**

Railroads and other users of motor-lead cables have had to wait months for delivery of motor-lead cables from the manufacturers. One way to avoid resulting delays to repair work is to salvage old leads. The accompanying sketches show four ways of doing this.

The left hand sketch in Fig. 1 shows two main field coils from a 250-hp., 750-volt traction motor as usually connected. The two motor leads extend from the rear

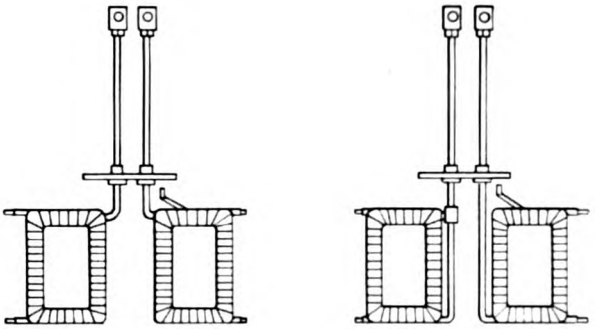


Fig. 1—The change in traction motor field leads as shown reduces length of lead wire and does not change motor speed

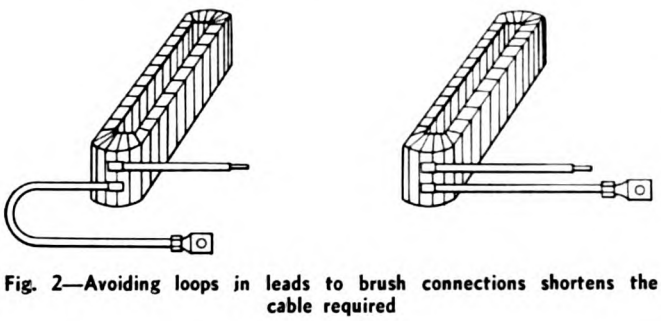


Fig. 2—Avoiding loops in leads to brush connections shortens the cable required

of the field coils, going to the front of the motor and then to the line. The right hand sketch shows the same two field coils with the two motor leads connected to the same two circuits as before, but the leads now come out the front of the coil. By effecting this simple change, it is possible to save about 6 or 7 ft. of cable per motor. A test motor on which this change has been made has been running over a year with satisfactory results.

At the time the alteration was being made, several persons offered divergent opinions as to how it would perform. Some said it would "heat up," while others declared it would "speed up." However, upon running this motor with three others on an hour's test in the shop, the speed of all four of the motors was about the same.

Figure 2 also shows two field coils from a traction motor. The field at the left has one lead with a turn in the cable made to reach the brush holder. The leads can be brought out in the same direction as shown at the right. In some instances, this operation will save two or more feet of lead cable on one motor.

Many minor cracks in motor-lead cable can be sealed with Minerlac, or some other flexible insulating sealing compound, with the aid of a hot sealing iron. Figure 3 shows a heating iron as used for sealing the cracks in a piece of cable. The iron can be made conveniently fro a brass bushing 1¾ in. in diameter and 2 in. long with hole 1⅛ in. bored through the center of the bushin

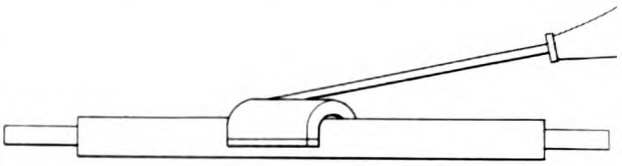


Fig. 3—A shop-made sealing iron as used for sealing cracks in cab

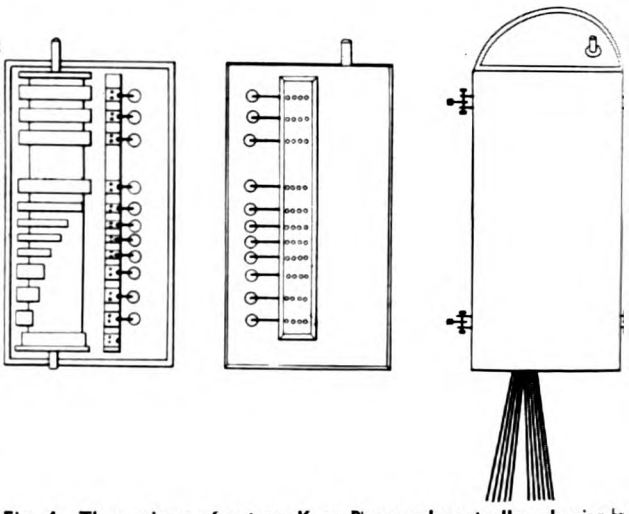


Fig. 4—Three views of a type K or R ground controller showing ho leads may be brought out the back of the case instead of in the for of long cable leads out of the bottom

The bushing is cut in half and to one of the halves welded a piece of ¼-in. brass or iron rod 8 in. long a shown. A wooden handle on the other end of the ro protects the user's hand. Sharp edges should be file from areas where the iron makes contact with the cabl

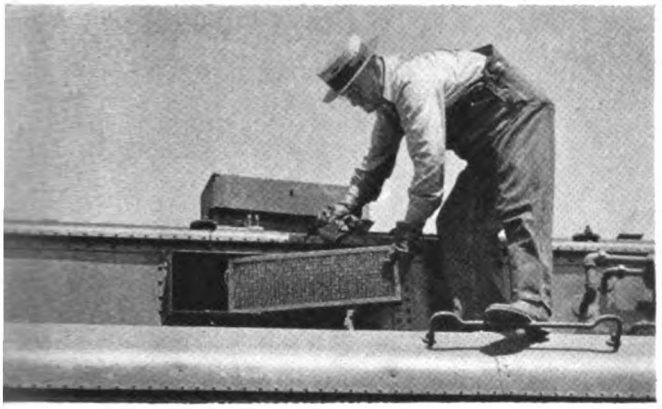
A type K or R controller such as are used in man railroad shops to operate traveling cranes, jib crane turntables, and transfer tables is shown in Fig. 4. I these controllers each wire is soldered in a finger bas The wires always run out the bottom of the controlle and under the crane cage and then up to the motor When trouble develops and the controller goes to th shop for repairs, the electrician usually splits the connec tion under the crane cage; thus when the controller goe to the shop it has lengths of wire coming from each fin ger base; wire which is usually replaced with new.

With the connector block on the back of the controller it is possible for the electrician to disconnect the con troller and at the same time leave the wires on the cran without throwing them away.

* * *



* Armature winder, Illinois Central.



Air Filters

What can I do to get the best service and longest life from the evaporator and condensers in our air-conditioned cars?

Geography Often Controls Methods

The question of performance of air filters with reference to periodic cleaning and proper air filtration is one of long standing. The governing factors are type of service and geographical territory through which the cars are operated, plus the type of locomotive used in handling the train. Where electric, Diesel or oil burning locomotives are used there are no cinders; on the other hand, if in the Southwest where sand and a great amount of dust is encountered, the cleaning period must be of shorter length.

It is my understanding that on a number of railroads the procedure followed in cleaning filters is to use a high-lift type gun with cleaning solution or to boil them in a vat of such solution, allow the filters to dry, then dip in a vat or tank of hot oil and allow to drain. This procedure consumes considerable time and labor, both of which are vital under existing conditions. I have found by blowing filters, that is, those of the expanded metal or wire mesh type, with high-pressure air, steaming them with live steam and blowing with air to dry, and then by using one of many types of spray guns, the oil can be applied in such a manner as to impregnate the filter properly without an excessive amount of oil. On a car using three filters, the total time required for the removal, cleaning and reapplication of filters consumes only about an hour for one man. If extra filters are available, this time can be reduced.

If it is felt that such a procedure does not clean the filters to a fine degree, then the high-lift gun cleaning could be used, say, twice a year.

One thing often overlooked on cars using a filter in the return air grill or in the plenum chamber to filter both outside and return air is, that if both cars are swept while the air-circulating fan is running, the lint and dust raised is drawn directly into the filter, and in a short time the air-flow through such filters is restricted to a point where it reduces the cooling capacity of the car.

This feature can only be overcome by a vigorous program of education of all employees who operate the equipment when cars are in service in trains. This educational program can be carried out by means of bulletins or circular letters and, if necessary, instruction classes. One of the most effective types of bulletins is a printed notice on or near the air-conditioning panels of each car.

Air filters, like other materials, are hard to procure under the war program, and filters used in return air grills can be removed entirely on a great number of cars. In such cars a removable frame covered with a fine mesh screen would serve the purpose of preventing a large portion of lint and dust from collecting on the coils of the evaporator or the overhead heating unit.

The periodic cleaning period should be at least every thirty days, unless operating conditions and territory prove that it can be extended.

JOHN V. DOBBS,
Car lighting and air-conditioning inspector, Atchison, Topeka & Santa Fe, Albuquerque, N. M.

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York.

The rubber situation, the heavy passenger traffic and the shortage of maintenance forces have made a new problem out of an old one. What under the circumstances can be done to preserve and improve the life of flat axle generator belts?

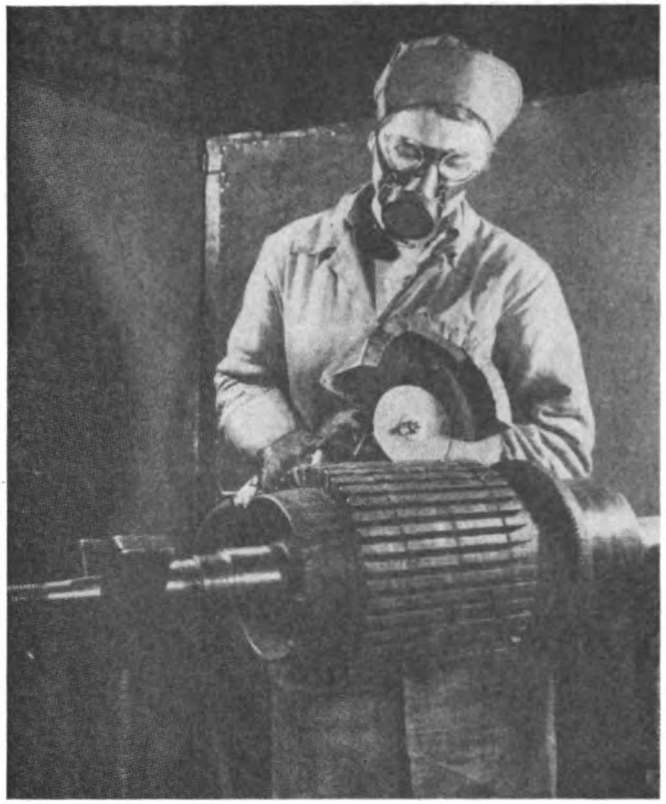
Inspect More Frequently

Any air-conditioning system depends upon air circulation within the area to be conditioned, and if the air is to be properly conditioned, it must be clean and free of objectionable odors. This end cannot be accomplished if the recirculated air filters are clogged or dirty to the extent that proper movement of the air through them is retarded, or if the fresh air filters are so clogged that a sufficient quantity of fresh air is not admitted to the plenum chamber for mixing with the return air to replenish oxygen, dispel odors, etc.

Therefore, to achieve the best possible performance of the air-conditioning equipment as a whole, there is only one suggestion that can be made for getting "the best possible performance out of the air-conditioning filters," and that is *Keep them clean.*

In view of present-day operating conditions with frequent delayed train schedules, quick doubling and turnarounds of equipment, extra trains and cars, etc., it just means that closer attention and more frequent inspections and cleaning of these filters will be necessary if desired results are to be obtained. This cannot be impressed too strongly on the maintenance forces, and the rule applies with equal force to the evaporators, cooling coils and condensers—in fact, any part of the systems involving the free passage of air.

W. J. DAWSON,
Kansas City Terminal Company, Kansas City, Mo.





Women in the Electrical Department



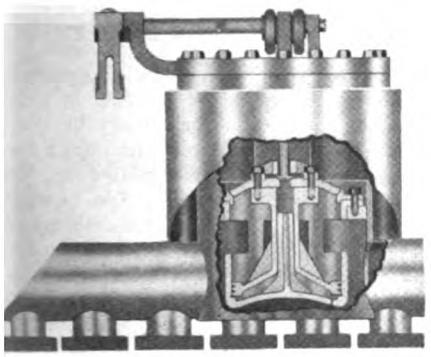


Upper left—Pennsylvania woman worker grinds armature slots preparatory to re-winding. Upper right—An electric locomotive switch being assembled in the Pennsylvania's Wilmington, Del., shops. Lower left—Dirt is removed from a multiple-unit car switch group on the Illinois Central. Lower right—A woman tests locomotive pantograph pressure on the Pennsylvania

NEW DEVICES

Compact Headers Save Front-End Space

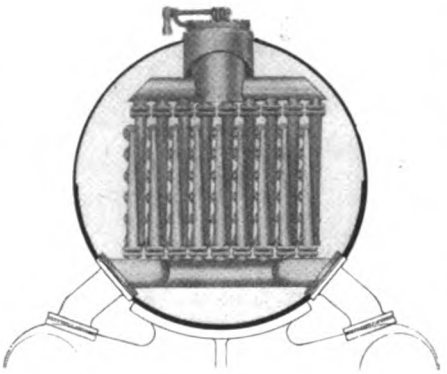
Designed to provide a continuous downward flow of steam from its entrance into the dry pipe through the headers and units to the cylinders, the C-S superheater, unit type, has been developed by the J. S. Coffin, Jr., Company, Englewood, N. J. The system is substantially self-draining and free from intricate cored passages and pipe bends. Steam travels but once in each direction through the units. The units are designed without internal or external obstructions. The self-draining arrangement makes it unnecessary to blow them out after a hydrostatic test has been made; the opening of the cylinder cocks drains the system. This feature reduces to a minimum the accumulation of scale deposits due to priming or carry-over.



The C-S throttle valve with the top header integral

The compact arrangement of the headers results in a saving in front end space which can be utilized to increase the length of tubes and flues, thus adding to the evaporative capacity. Light weight design permits this additional heating surface without increase in total weight.

The units have 77 per cent of their surface subject to counter-flow heat transfer from gas to steam which results in a high rate of heat transfer per square foot of surface. This, combined with a greater heating surface per foot of unit length, gives maximum superheat temperatures. All units for a given class of locomotive are identical and interchangeable. The same design is also standard and interchangeable on all classes having large flues of the same length. The manifolds on the ends of the unit are of heat-resisting forged steel, without bends or machined joints.



Front-end view of superheater and throttle valve

The diagrammatic arrangement shown includes the C-S throttle, front-end type, which is located in the smoke box and is integral with the saturated steam top header. This method of front-end throttling is made possible with units of this type because of the self-draining feature and affords protection in the event of burst superheater tubing by controlling the steam at this point.

The design of these units provides for a pressure drop which is intended and necessary for the protection of superheater units against over-heating. This pressure drop is a maximum of 10 lb. when a locomotive is operating at design capacity.

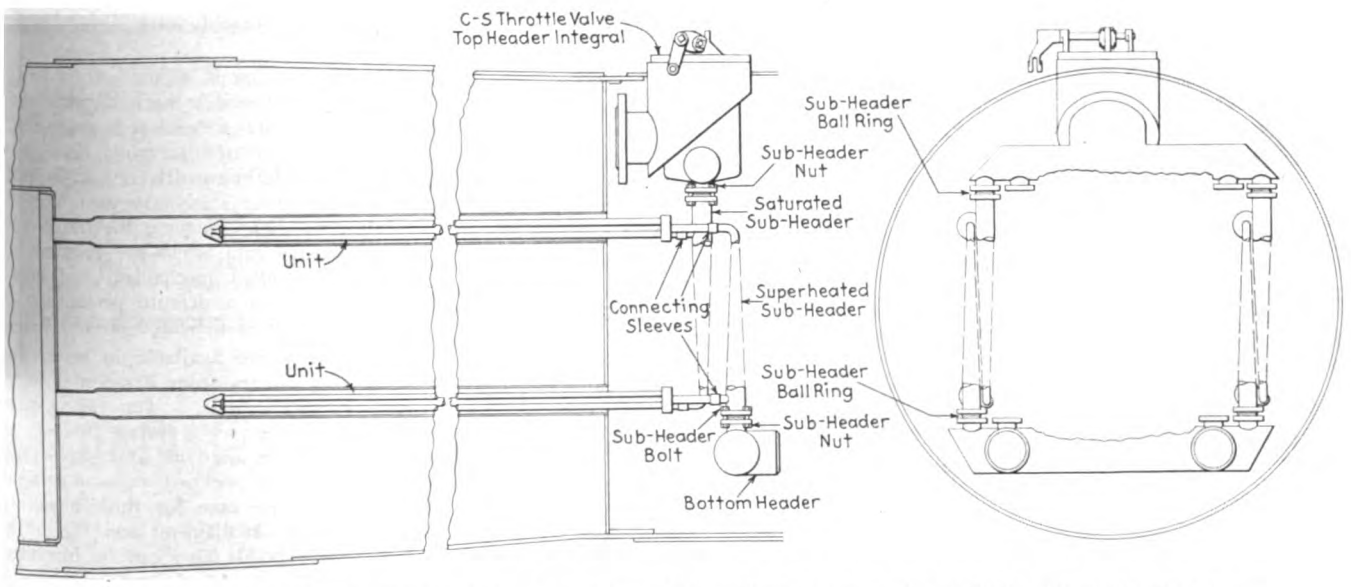
The small number of joints and accessibility contribute to low maintenance cost. No special tools are required. All joints can be ground together and the only machined surfaces which require maintenance are at the ball flanges.

Plastic Battery Retainer

A slotted plastic storage battery retainer manufactured from polystyrene is now being used by The Electric Storage Battery Co., Philadelphia, Pa., for certain types of Exide batteries.

Retainers are a part of the separation or insulation between positive and negative plates and act principally to retain the active material in the positive plates. They play an important part in the performance and life of a storage battery.

The new retainer is said to be more permanent than the former type and also to have other technical advantages. It is the result of extensive field tests, its development having been hastened by the shortage of rubber. Although the basic raw materials used for making the polystyrene re-



A diagrammatic view of the arrangement of the C-S superheater—The headers are also available without throttle valve



The slotted polystyrene retainer is used for certain types of Exide batteries

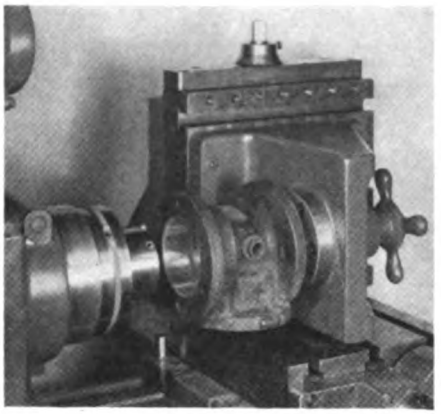
tainer are still on the critical list, it can be manufactured from secondary materials, by-products from the use of this material for other war purposes.

Reconditioning Worn Air Brake Parts

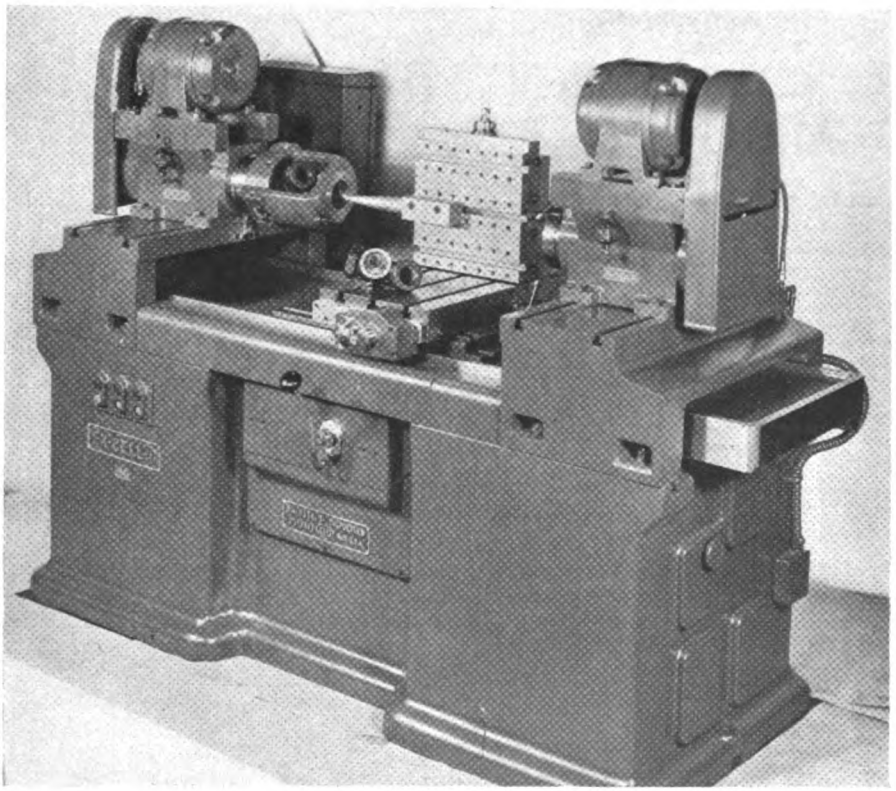
The use of a precision boring machine with the necessary fixtures and gauges is reported to have resulted in the reclamation of many air brake parts which formerly were scrapped when abrasive lapping operations were depended upon to restore worn surfaces to required dimensions for reapplication. The machine, built by the Ex-Cell-O Corporation, Detroit, Mich., has enabled one large railroad system to centralize the repair of all such parts subject to reclamation at a saving in cost per unit, with closer adherence to required tolerances.

When the installation of the machine was first made attention was directed primarily to the reclamation of tapered bodies and keys for 1¼-in. angle cocks. Examination of these parts, which had previously been repaired by abrasive lapping, disclosed an out-of-round condition. In turning down the keys it was necessary in some cases to reduce them to a size too small in diameter to fit the reclaimed bodies. However, bodies were rebushed and bored to size so that the undersize keys could be fitted to them. The present practice is to grade parts according to size and in this way oversize and undersize parts, formerly scrap, are now made serviceable. The use of check gauges simplifies the mating of parts and re-assembly operations. This selective repair and assembly is said to have increased production 150 per cent over previous methods.

In all 28 separate parts are now being reclaimed on this one machine using a variety of tools mounted on a universal adjustable fixture.



This set-up is used for the straight boring of bushings in triple, automatic control, universal, distributing, AB reducing and feed valve bodies



Machine with universal fixture used for boring angle cock bodies

Percentage Timer

A percentage timer which automatically controls the percentage of time at which any a.c. circuit can periodically be closed or opened out of a definite length of a time cycle has been made available by The R. W. Cramer Company, Inc., Centerbrook, Conn. The timers are designed for controlling proportionate flow of chemicals for boiler feed water treatment or any application where one function bears a definite time relation in percentage or operation of a second function. It has a self-starting synchronous motor which drives a cam-operated switch mechanism through the medium of an enclosed gear train. The percentage of operating time is a function of the motor-driven cam in relation to a similar stationary cam fixed to a calibrated dial. Varying the position of the stationary cam alters the relation between the contact mechanism and opens and closes it at a definite percentage of the total cycle as indicated on the dial.



The timer is enclosed in a dust-tight molded Bakelite case

The timers are available in seven different time ranges from 30 seconds to 60 minutes total cycle. The single-pole, single-throw contact is rated 10 amp. at 115 volts or 5 amp. at 230 volts. The entire timer is enclosed in a dust-tight molded Bakelite case for flush mounting and is 3¼ in. in diameter and 3 $\frac{9}{32}$ in. in overall length. It also can be furnished with various types of surface-mounting steel connection boxes.

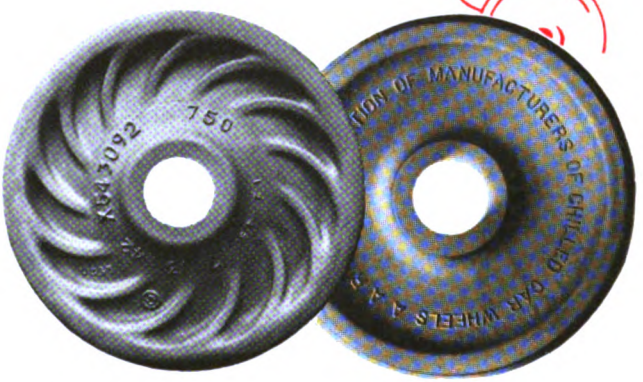
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THE CHILLED CAR WHEEL CONVERSION PLAN

assumes great importance in Wartime!



Uncle Sam has asked us all to save vital metals. Is there any group, other than the Manufacturers of Chilled Car Wheels, that reuses 88.38 per cent of its product? Only 11.22 per cent of the total metal used in the production of the 2,682,000 Chilled Car Wheels delivered to the railroads of the United States and Canada in 1942 was new pig-iron!



1942 CHILLED CAR WHEEL PRODUCTION:

2,682,000 Chilled Car Wheels were delivered in 1942.
885,020 Tons of metal were used to make them.
Of these:
782,181 Tons or 88.38% were scrapped wheels.
99,299 Tons or 11.22% were new pig-iron*.
3,540 Tons or .40% were alloys.
This *IS* Salvaging Scrap for the War Effort!
*Secured with the cooperation of W.P.B.

Under our wheel exchange plan, by which the railroads receive new Chilled Car Wheels for old on a conversion charge basis, scrapped chilled wheels are speedily recast into new wheels. And, with 38 foundries strategically located in the United States and 8 in Canada, the railroads are assured of quick delivery and minimum delivery costs of Chilled Car Wheels.

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3328

High Spots in
Railway Affairs . . .

Retirement Board Activities Reduced

There has been a considerable curtailment in the activities of the Railroad Retirement Board during the fiscal year which closed June 30. This is accounted for, according to M. W. Latimer, chairman of the board, by a decline in the retirement claims filed and the manpower difficulties of the railroads, which slowed down the receipt of records required for the prior service program. There was also a drastic decline in the receipt of claims for unemployment insurance. It is said that these payments are expected to be about 20 per cent less in the 1943 fiscal year, as compared to 1942 figures. The Railroad Retirement Board's personnel was reduced by about 27 per cent during the year.

Freight Traffic Growing

It is now generally recognized that freight car loading figures no longer form a good measuring stick for the amount of freight business being handled by the railroads. Revenue ton-miles furnish the best basis of comparison, but these statistics naturally lag far behind the car loading figures. The revenue ton-mile figures for Class I railroads for April of this year exceeded those of April, 1942, by 18 per cent. During the first four months of this year the Class I railroads performed 26 per cent more revenue ton-miles of service than in the same period last year. Compared with the first four months of 1939, the increase was 138 per cent.

Oil Movement

The movement of oil to the East Coast by the railroads reached its high point in the week ending May 15, when they delivered an average of more than 980,000 barrels a day of petroleum and petroleum products in tank cars. In addition to this, kerosene in drums loaded in box cars accounted for 17,239 barrels a day. The floods slowed up this movement, although the railroads made an excellent showing by going to unusual lengths to keep the oil moving. The fact that it is handled largely in solid trainloads made it possible to keep close track of the movement and simplified the problem of detouring the trains and speeding up the movement wherever possible. The situation was complicated by damage to the "Big Inch" pipe line from Longview, Texas, to Norris City, Ill. For the week ended June 5 the oil movement continued to climb back to the pre-flood level. The daily average in tank cars was 898,744 barrels and kerosene in drums amounted to 9,699 barrels per day.

The Grain Movement

While the storage facilities problem in handling the wheat crops in the West is always a troublesome one, the situation in this respect this year is said to be better than that of a year ago. The problem this year is one of car supply, and of labor to get the wheat from the farms and to load and unload the cars. In Wichita, Kan., for instance, where the elevators must compete for labor with the local airplane plants, it is reported that in one elevator alone, where 20 power unloader shovel operators are ordinarily employed, only two men are available for this work this year. From the railroad standpoint, military transportation is requiring such a large percentage of the equipment that there has been no possibility of storing surplus cars in the wheat territory, ready to move the grain promptly as it is harvested. It is reported that it may be necessary to store much of the wheat on the ground temporarily to await the time when it can be moved to the local elevators, and in turn be transferred to the grain centers.

Railroads Complimented for Their War Performance

Major General C. P. Gross, Chief, Transportation Corps, U. S. Army, recently gave the New York Chamber of Commerce a dramatic picture of the part that transportation is playing in the present war. "Mechanized warfare," he said, "requires tremendous transportation capacity. It takes 75 trains and 2,700 cars to move an armored division with its 3,700 odd vehicles by rail, and to move it overseas with its reserve complement of equipment and supplies, takes at least 15 Liberty ships in addition to the necessary troopships." In comparing conditions with the first World War he pointed out that the operations at that time were concentrated in a single theatre and shipping was largely confined to the North Atlantic. Today, our operations embrace the seven seas and spread to every corner of the globe. We literally cover the earth. In discussing the various agencies that are involved in the splendid transportation record that is being made, the General had this to say of the railroads: "Moreover, this war found the railroads of this country splendidly organized under a voluntary central control agency known as the Association of American Railroads, and it has responded magnificently to every call. The railroads are carrying from three to four times as much army freight as they did in 1917 and 1918 and they are doing it with 20,000 fewer locomotives and 500,000 fewer freight cars."

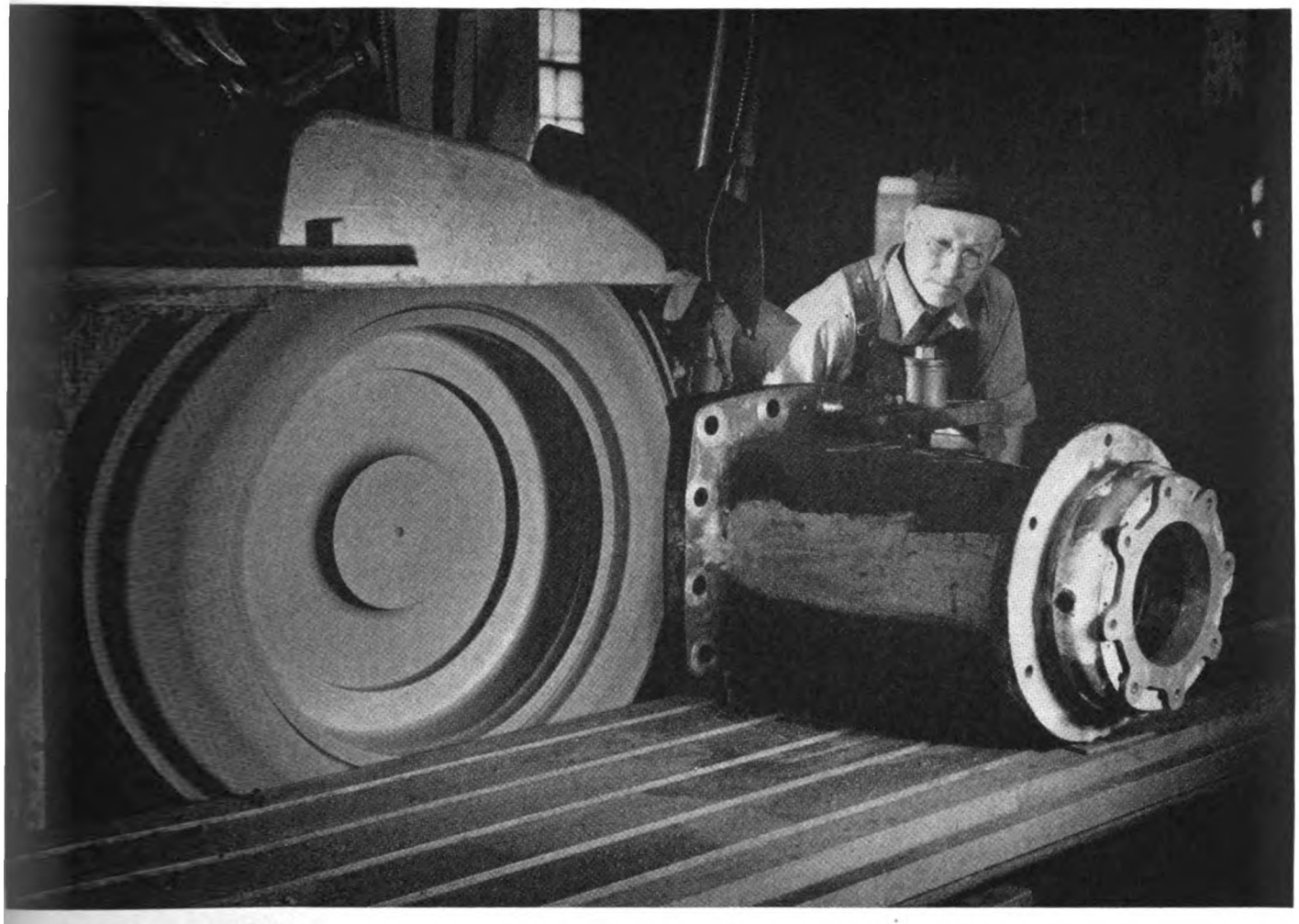
Western Railroads Face Difficult Task

Our military operations in the Pacific ar have thrown an unexpectedly heavy lo upon the western railroads. While th have thus far stood up pretty well und this impact, it seems apparent that it only a starter and that they must prepa for a very much greater increase in traf as the war with Japan develops. Col. E C. R. Lasher, deputy chief of the Traf Control Division of the Army Transpo tation Corps, in addressing a meetin of the Trans-Missouri-Kansas Shippe Board, pointed out that the war with Jap will "mean the bitterest kind of sustaine campaign." He said that our forces in th western Pacific will eventually be built u to many times their present strength. Th will necessitate an increased flow of freig and passenger traffic westward and a bi ger load on top of the heavy one whi the western railroads are now carryin The conflict in the Pacific is undoubted responsible for part of the longer freig and passenger hauls reported by the Ame ican railroads in 1942. According to Co onel Lasher, the average haul of War D partment freight was approximately 9 mi., compared with 450 mi. for the cou try as a whole; the average distance tra eled by each soldier on a trip was 800 mi compared to 120 mi. for the entire natio

Vacation Travel

While the O. D. T. apparently does n consider vacation travel essential, it seem inclined to give it preference over the mo obviously unessential items—to a certai extent it leaves the decision to the patri otic judgment of the individual. If people d feel that their vacation travel is justifie then the O. D. T. asks them to take th following ten rules into consideration: Take the vacation, if possible, in the fa or winter and not in July or August, whe travel normally increases. 2. Take th whole vacation at one time; do not spl it up into several short periods or a num ber of weekends. 3. Begin and end th vacation on a Tuesday, Wednesday Thursday. 4. Spend the vacation as ne home as possible. 5. Go to one place an stay there. Travel on day coaches, carr box lunches on trains to avoid putting further burden on Pullmans and dinin cars, and avoid overnight trips. 7. Carr as little baggage as possible and check th heavy pieces. 8. Plan to allow for tran portation contingencies requiring last-min ute changes. 9. Be prepared to expect de layed arrivals, crowded conditions, an lack of the usual travel comforts. 10. Re member most supplementary services to re sort areas will not be running this yea

(*Turn to next left-hand page*)



Joints under pressure are made steam tight at Lima. By such attention to details Lima has won a reputation for soundness of construction that backs up its leadership in locomotive design.

SERVICE ...the proving ground of locomotives

The long, grueling service under which locomotives have been operating for the past few years is a worthy proving ground of soundly-built locomotives.

Lima-built locomotives have long had a reputation for high performance and for low maintenance. And today this reputation is being further augmented by the high "availability" of Lima power.

The ability of Lima-built locomotives to "take it" is due in great measure to the many special methods and tools that have been developed at Lima to insure greater accuracy of manufacture and resultant higher degree of availability.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

NEWS

Lawford Fry Becomes Research Director

LAWFORD H. FRY has resigned as railway engineer of the Edgewater Steel Company, Pittsburgh, Pa., to become director of research of the Locomotive Institute, New York.

Mr. Fry was for many years associated with the Baldwin Locomotive Works and has a wide reputation for his contributions and ability in the field of locomotive design and construction. He is a Fellow of the American Society of Mechanical Engineers and at its 1938 annual meeting was



Lawford H. Fry

awarded the Worcester Reed Warner Medal for "written contributions relating to improved locomotive design and utilization of better materials in railway equipment." He is the author of a book, A Study of the Locomotive Boiler, and has contributed a large number of articles and papers on locomotives and on metallurgical subjects to engineering societies and to the technical press of this country and England.

Mr. Fry is a member of the American Society for Testing Materials and is a member of its executive committee. He is also a member of the following British institutions: The Institution of Civil Engineers, the Institution of Locomotive Engineers, and the Institution of Mechanical Engineers. In 1928 he was the recipient of a T. Bernard Hall prize for his paper, Experiments with a Three-Cylinder Compound Locomotive. He is also a member and has been active in the Newcomen Society.

Mr. Fry was born in Richmond, Province of Quebec, Canada, and obtained his technical training at the City and Guilds of London (England) Technical Institute, the University of Goettingen, and the Hannoversche Technische Hochschule. He was in the shops of the Baldwin Locomotive Works, 1897 to 1899; sales engineer, 1904; and engineer of tests, 1905. He then became European technical representative of the company. Returning to this country in 1913, he became head of the metallurgical department, Standard Steel Works, Burnham, Pa., and remained there as metallurgical engineer until 1930.

A. A. R. Board Approves Technical Research

CREATION of a central research organization, under the management of a director of technical research, to engage in fundamental, basic research with a view to possible improvement in the engineering and mechanical aspects of railroading has been authorized by the board of directors of the Association of American Railroads.

More Steel Expected in Third Quarter from WPB Drive

INCREASED allotments of steel to the railroad industry is expected to result from the War Production Board's drive to increase steel production by 1,000,000 ingot tons in the third quarter. The drive is under way as a result of a demand from War Mobilization Director Byrnes, who is understood to have acted upon representation from the armed forces.

Most of the increased production is therefore expected to be allotted to the Army and Navy, but the railroads are nevertheless expected to get a "substantial" increase in their current allotment for the third quarter. Details of the latter with respect to the equipment situation were reported on page 293 of the June *Railway Mechanical Engineer*.

Proceedings

THE 1942 Proceedings of the Car Department Officers' Association are now available from the secretary-treasurer, F. H. Stremmel, assistant to secretary, Mechanical Division, Association of American Railroads, 59 East Van Buren street, Chicago, at a cost of $2.

Burlington Material Being Used in Navy Cars

MATERIAL which the Chicago, Burlington & Quincy had on hand at the beginning of the war for the construction of freight cars in its own shops, and which was frozen by the War Production Board, is being used in the construction of cars for the Navy. A contract for the construction of 170 special box cars has been placed by the Navy with the Burlington on a non-profit basis and about 90 per cent of the material used in their construction is coming from the frozen stock piles. The cars, which are being built at the Havelock, Neb., shops at the rate of ten a day, will be 50½ ft. long and will have 10-ft. doors and special interior fittings for handling naval supplies.

Loftis Appointed Assistant to Boatner in ODT

J. D. LOFTIS, JR., mechanical assistant in the Division of Railway Transport, Office of Defense Transportation, has been appointed assistant to Director V. V. Boatner of the Division, succeeding James F. Haley, who resigned to accept a commission in the Air Transportation Corps.

A Supply Company Becomes a General Research Agency

STARTING with a few special instruments needed in the study of problems related to the development of its own products, the Waugh Equipment Company, New York, has gradually expanded the scope both of the instruments and personnel with test engineering training until Waugh Laboratories are furnishing both for test investigations in defense production as well as in other private industries. Starting with such equipment as the car impact test plant, a 9,000-lb. drop hammer for testing draft gears, impact registers, and the simple scratch-type strain gages with which the railway field is familiar, there has been a gradual accumulation in the laboratory of a wide variety of instruments adapted for the investigation of problems in many other fields, including bridge engineering.

(Continued on next left-hand page)

Orders and Inquiries for Equipment Placed Since the Closing of the June Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Bingham & Garfield	2[1]	Mallet	Baldwin Loco. Works
Chesapeake & Ohio	10[2]	Mallet	Lima Loco. Works
Chicago, Rock Island & Pacific	10[3]	4-8-4	American Loco. Co.
Indianapolis Union	3	0-8-0	Baldwin Loco. Works
Pittsburgh & Lake Erie	25[4]	0-8-0	American Loco. Co.

[1] Duplicates of 20 ordered recently from the same builder.
[2] To cost approximately $2,750,000. Delivery is scheduled to begin the first quarter of 1944. The new engines will haul freight over mountains between Clifton Forge, Va., and Hinton, W. Va., and will be similar to 20 locomotives placed in service on that route during 1941 and 1942.
[3] Purchased authorized by the District Court at Chicago.
[4] Approximate cost, $2,000,000.



Booster Power keeps *war goods* moving

When extra cars are added the Booster-equipped locomotive gets the train started.

When a combination of bad rail and grade is slowly stalling a heavy train, the added power of the Booster* comes to the rescue.

Engineers of Booster-equipped locomotives bear witness to hundreds of instances like these, where the extra power of the Locomotive Booster has kept traffic moving.

Thousands of Booster-equipped locomotives are helping speed war-time traffic.



*Trade Mark Registered U. S. Patent Office

FRANKLIN

RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL



Test being made with magnetic strain gages employing the Waugh switching unit for aid in measuring strains

steel structures, the behavior of reinforced concrete under load, the oil industry, marine engineering, airplane design, and studies in the development of military combat materiel, including automotive vehicles.

The laboratory equipment includes a particularly wide variety of strain-measuring instruments, both of the scratch type and various electrical and electro-magnetic types, with auxiliary equipment adapted for use in the study of records and for the convenient and rapid reading of strain measurements when they are being made at a number of locations on a structure. For dealing with vibrations and noise measurement, the equipment ranges from the Bernhard mechanical oscillator capable of setting up oscillating forces up to 20,000 lb. for the study of the effect of periodic vibrations in bridges, ships, and other structures, to sound-level meters for the measurement of high frequency oscillations in a wide range of fields, not excluding sound and other vibratory phenomena in steam railway equipment.

As the variety of instruments which were available in the Waugh Laboratories gradually increased, they have been utilized for various engineering studies, at first by the railroads and, since the beginning of the war, by many other industries. Some of the instruments are commercially available; others, however, were developed in the laboratories to meet special requirements and are not available elsewhere. This applies particularly to a number of the instruments employing magnetism and electrical resistance for the measurement of stress and high-frequency vibrations.

This is a case of a railway supply industry furnishing facilities for research in other fields of transportation which, in the public mind, are much more frequently associated with research than are the railway and railway supply industries.

A. S. M. E. and Pacific Railway Club Hold Joint Session

THE Pacific Railway Club joined with the Railroad Division of the American Society of Mechanical Engineers in a discussion of some of the post-war problems of the railways at a session on June 15, during the semi-annual meeting of the A. S. M. E., held at Los Angeles, Calif., June 14 to 17. Two papers were presented and discussed, one on railway equipment needs, characteristics and design of the post-war era, by L. F. Etter, head of the service department, Pacific Railway Equipment Company, Los Angeles, and the other on the influence of new materials and machinery on post-war railway freight equipment, by Morris P. Taylor, assistant mechanical engineer, Southern Pacific, San Francisco, Calif. The session was opened by H. S. Wall, mechanical superintendent, Atchison, Topeka & Santa Fe, vice-president of the Pacific Railway Club, who turned the meeting over to Paul K. Beemer, chief engineer, Pacific Railway Equipment Company, representing A. S. M. E.

Supply Trade Notes

NATIONAL MALLEABLE & STEEL CASTINGS CORPORATION.—*Walton L. Woody* has been elected vice-president in charge of operations of the National Malleable & Steel Castings Co., with headquarters at Cleveland, Ohio. Mr. Woody was formerly assistant to the president in charge of the Sharon, Pa., and Melrose Park, Ill., works. A sketch and photograph of Mr. Woody appeared in the February issue at the time of his appointment to the latter position.

◆

GOULD STORAGE BATTERY CORPORATION.—*John C. Sykora* has been appointed vice-president, and *Roy J. Stanton*, motive power sales manager, of the Gould Storage Battery Corporation at Depew, N. Y.

John C. Sykora has been with the Gould organization for nearly a quarter of a century, having entered the New York office in 1919. Eight years later he was transferred to Depew as assistant to the general sales manager. Mr. Sykora has made his headquarters in Depew since 1927, except for one year when he acted as special representative of the Gould Company in Washington, D. C. He was appointed sales manager in 1940.

Roy J. Stanton, formerly employed for a number of years by the United States Light & Heat Corporation, became a member of the Gould sales force when Gould took over the industrial division of U. S. L. He first covered several different territories for Gould and later assumed charge of the company's Detroit office. In his new position he will make his headquarters at Depew.

◆

GISHOLT MACHINE COMPANY.—*C. K. Swafford*, works manager and a member of the board of directors of the Gisholt Machine Company, Madison, Wis., has been elected a vice-president of the company. Mr. Swafford entered the employ of the Gisholt company in 1913. Shortly after the United States entered the first World War, he was transferred to other activities, returning to the company in 1930 as works manager. He continues to serve also in this capacity.

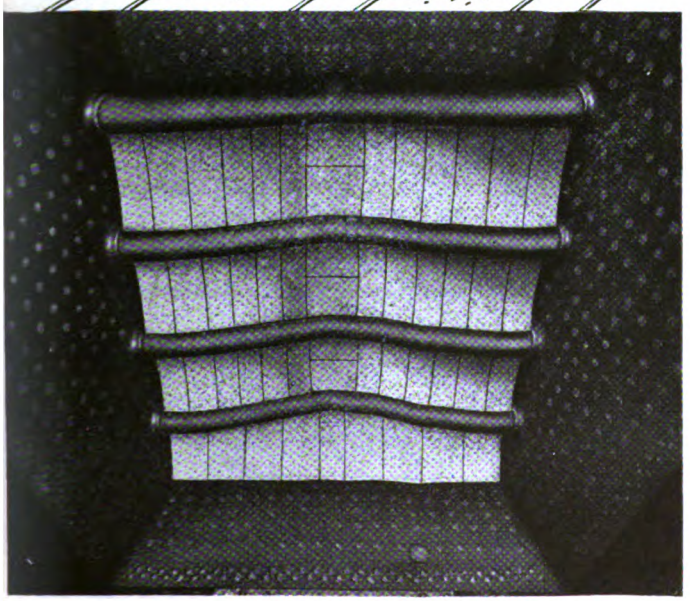
◆

ALLEGHENY-LUDLUM STEEL CORPORATION—*Robert H. Gibb*, manager, Pittsburgh district sales office of the Allegheny-Ludlum Steel Corporation, has accepted a commission in the United States Navy, and the duties formerly performed by him will be taken over by *Max Pischke*, who will have the title of acting district manager. Mr. Gibb has been in the Pittsburgh district sales office for several years, having served as assistant district manager there until his appointment to the managership in January, 1943. Mr. Pischke has been with the Allegheny-Ludlum Pittsburgh sales office for the past two years.

(*Turn to next left-hand page*)

Here's help in maintaining *Fuel Burning Efficiency*





More than 30 years ago the fundamental value of the Security Sectional Arch in increasing coal-burning efficiency was established by railroad men themselves.

Make sure that full use is being made of this proved help in obtaining the maximum steam production from each pound of wartime fuel.

This means a complete arch in every locomotive in service.

HARBISON-WALKER REFRACTORIES CO.
Refractory Specialists

AMERICAN ARCH COMPANY, INC.
60 EAST 42nd STREET, N. Y.

Locomotive Combustion Specialists

INDEPENDENT PNEUMATIC TOOL COMPANY.—*Neil C. Hurley,* whose election as executive vice-president of the Independent Pneumatic Tool Company, Chicago, was reported in the May issue of the *Railway Mechanical Engineer,* graduated from Notre Dame in 1932, and in the same year entered the service of the Independent Pneumatic Tool Company. In 1935 he was promoted to secretary, and four years later was elected vice-president and a director, holding the former position until his new appointment, effective April 1.

◆

AMERICAN BRAKE SHOE COMPANY.—*George L. Rieger* has been appointed assistant general superintendent of the Ramapo Ajax Division of the American Brake Shoe Company, with headquarters at 230 Park avenue, New York. *Roy L. Salter*



George L. Rieger

has been appointed general superintendent of the Southern Wheel division of American Brake Shoe Company, with headquarters at the company's New York offices.

George L. Rieger was born in 1891. He joined the Ajax Forge Company in July, 1916, as a planer hand and a few years later was transferred to the company's Chicago plant as assistant foreman. He was promoted to the position of foreman in 1927 and transferred to the Los Angeles plant. A year later he was transferred back to Chicago as general foreman. Mr. Rieger was appointed superintendent of the Ramapo Ajax plant at Hillburn, N. Y., in 1940, serving in that capacity until his promotion to assistant general superintendent at New York.

◆

SKF INDUSTRIES, INC.—*Robert R. Zisette,* for the past year assistant sales manager, has been promoted to the position of general sales manager of SKF Industries, Inc., Philadelphia, Pa. Mr. Zisette has been in the employ of the company since 1921, serving as sales engineer in the Cleveland, Ohio, office, and district manager of the Cincinnati office.

◆

IRON & STEEL PRODUCTS, INC.—*Frank Parker,* president of Iron & Steel Products, Inc., Chicago, has been elected chairman of the board, and has been succeeded by *Albert G. Bladholm,* secretary. *John F. Parker,* vice-president, has been elected vice-president and treasurer; *William J. Parker,* vice-president, has become vice-president and secretary and *Royal J. Casper* has been appointed assistant secretary.

Frank Parker entered the employ of the Republic Iron & Steel Co., in 1905 and in 1917 resigned from the position of general



Frank Parker

superintendent, Western division, to engage in the scrap-iron and general iron and steel salvage and equipment business. In 1930 he formed Iron & Steel Products, Inc.

Albert G. Bladholm entered the scrap-iron and general iron and steel salvage and equipment business in 1923. In 1930 he



Albert G. Bladholm

assisted in forming Iron & Steel Products, Inc., and became its secretary, the position he was holding at the time of his recent election.

Army-Navy E Awards

American Locomotive Company, Latrobe, Pa. May 25.

Ampco Metal, Inc., Milwaukee, Wis. May 16.

Climax Engineering Company, Clinton, Iowa. May 7.

Gustin-Bacon Manufacturing Company, Kansas City, Kan. June 18.

Hughes-Keenan Company, Mansfield, Ohio. May 7.

SPERRY PRODUCTS, INC.—*Richard D. LaFond* has been appointed director of public relations of Sperry Products, Inc., Hoboken, N. J. Mr. LaFond will direct all advertising, publicity, and employee-morale activities for Sperry, in addition to inaugurating an enlarged program of customer-relations designed to make available the benefits of Sperry research and field application data to the railroad, marine and aviation industries. Mr. LaFond, before joining Sperry Products, was sales promotion manager for the Dresser Manufacturing Co., of Bradford, Pa., and prior to that time he was in the industrial advertising section of the General Electric Co., at Schenectady, N. Y.

◆

BALDWIN LOCOMOTIVE WORKS.—*V. H. Peterson,* for the past two years vice-president of the Elliott Company, has been appointed assistant to the president of the Baldwin Locomotive Works. Mr. Peterson was educated in the public schools of Waterbury, Conn., and started work as a



V. H. Peterson

draftsman for the Scovill Manufacturing Company of that city. He attended the continuation school conducted by the industries of Waterbury, and won a scholarship which enabled him to enter Rensselaer Polytechnic Institute of which he was a graduate, with a degree in mechanical engineering, in 1925. Mr. Peterson entered the service of the Elliott Company and, in 1938, after having served as sales engineer in the Pittsburgh office and as district manager of the Rochester and Washington, D. C., offices, he went to Jeannette, Pa., as assistant to the president in coordinating the sales activities of the company. In 1941 he was elected a vice-president of that company, with responsibility for all sales, advertising and service activities of their three plants.

◆

EDGEWATER STEEL COMPANY.—*William J. George* has been appointed assistant to the president in charge of products engineering for the Edgewater Steel Company, Pittsburgh, Pa. *Harry C. Riddile* has been appointed superintendent of the Ring Mill and Ring Spring departments.

◆

INLAND STEEL COMPANY.—*James S. Gregg* has been appointed district sales manager of the Cincinnati, Ohio, sales office of the Inland Steel Company. Mr.

Gregg, until his recent transfer to Cincinnati, covered the Wisconsin territory out of the company's Milwaukee sales office. He had been associated with Inland Steel since October 1, 1935. Prior to that time he was employed by the Moise Steel Company, Milwaukee, Wis. *Kenneth J. Burns*, who formerly headed the Cincinnati sales office, is now located in an executive capacity in the company's Plate and Shape sales division in Chicago.

◆

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—*Charles A. Hook*, president of the American Rolling Mill Company, and *Elisha Walker*, partner in the firm of Kuhn, Loeb & Co., have been elected to the board of directors of the Westinghouse Electric & Manufacturing Co.

◆

NATIONAL LOCK WASHER COMPANY.—*Arthur W. Preikschat*, manager of the car equipment division of the National Lock Washer Company, Newark, N. J., has been appointed vice-president in charge of manufacturing of the company, with headquarters at Newark.

J. H. WILLIAMS & COMPANY.—The Stock Products sales offices of J. H. Williams & Company have been moved from 225 Lafayette street, New York, to the company's plant at Buffalo, N. Y. A sales office will be maintained at the Lafayette street address to serve the Metropolitan area only.

Obituary

DANA RIPLEY BULLEN, retired assistant to the vice-president of the General Electric Company, Schenectady, N. Y., died recently at the age of 78.

◆

FRED W. VENTON, treasurer of the Allied Railway Supply Association and manager of the railroad sales department of the Crane Company, Chicago, died in that city on May 26.

◆

HARRY GLAENZER, vice-president in charge of engineering of the Baldwin Locomotive Works until his retirement in 1940, died on May 24. After being educated in the technical schools of Baltimore, Md., and at the University of Pennsylvania, Mr. Glaenzer became associated with the engineering department of Bald-



Harry Glaenzer

win in March, 1899. He was appointed chief engineer in 1921, and was elected vice-president in charge of engineering a year later.

Personal Mention

General

R. C. KEENAN has been appointed supervisor of apprentices of the Erie, with headquarters at Cleveland, Ohio.

F. C. RUSKAUP has been appointed assistant to general superintendent of motive power of the New York Central, with headquarters at New York.

A. L. OLSON, chief draftsman of the Chicago, Rock Island & Pacific at Silvis, Ill., has been appointed assistant mechanical engineer, with headquarters at Silvis, Ill.

W. C. BOWRA has been appointed assistant superintendent motive power and car equipment of the Montreal district of the Canadian National, at Montreal, Que.

DUMONT LOVE, who has been appointed general mechanical inspector of the Florida East Coast, with headquarters at St. Augustine, Fla., as noted in the June issue, was born in Shenandoah, Iowa. He entered the service of the Florida East Coast as a locomotive engineman in 1912, and served subsequently as road foreman of engines before becoming superintendent of air brakes at St. Augustine, the position he was holding at the time of his appointment to general mechanical inspector.

T. L. NICHOLS, master mechanic of the Atlanta & Saint Andrews Bay, has been appointed superintendent of motive power, with headquarters as before at Panama City, Fla. Mr. Nichols was born on December 15, 1900, at Chester, S. C., and attended Furman University, Greenville, S. C., for two years. Prior to his entering the service of the Atlanta & Saint Andrews Bay, he was employed by the Carolina & Northwestern, Southern, and the Norfolk & Western, successively.

A. F. LEPPLA, assistant mechanical engineer of the Chicago, Rock Island & Pacific, at Silvis, Ill., has been appointed mechanical engineer, with headquarters at

A. H. GLASS, mechanical assistant, operators, of the Chesapeake & Ohio, New York, Chicago & St. Louis, and the Pere Marquette, has been appointed chief motive power inspector of the Chesapeake & Ohio, with headquarters at Richmond, Va.

Master Mechanics and Road Foremen

J. D. HARLEY has been appointed master mechanic of the Savannah & Atlanta, with headquarters at Savannah, Ga.

J. J. NELSON has been appointed master mechanic of the Buffalo division of the Delaware, Lackawanna & Western, with headquarters at East Buffalo, N. Y.

L. B. JOHNSON, master mechanic of the Slaton division of the Atchison, Topeka & Santa Fe, has been transferred to the Pecos division with headquarters at Clovis, N. M.

W. W. LYONS, master mechanic of the Pecos division of the Atchison, Topeka & Santa Fe, has been transferred to the Western division, with headquarters at Dodge City, Kan.

H. E. ANDERSON, master mechanic of the Western division of the Atchison, Topeka & Santa Fe, has been transferred to the Slaton division with headquarters at Slaton, Tex.

H. C. FOSTER has been appointed road foreman of engines of the Chesapeake & Ohio, with headquarters at Clifton Forge, Va.

T. M. CONNIFF, master mechanic of the Buffalo division of the Delaware, Lackawanna & Western at East Buffalo, N. Y., has been transferred to the Morris and Essex division, with headquarters at Hoboken, N. J.

N. C. WARD has been appointed master mechanic of the Tallulah Falls with headquarters at Cornelia, Ga.

H. F. DEERY has been appointed road foreman of engines of the Baltimore & Ohio, with headquarters at Riverside, Baltimore, Md.

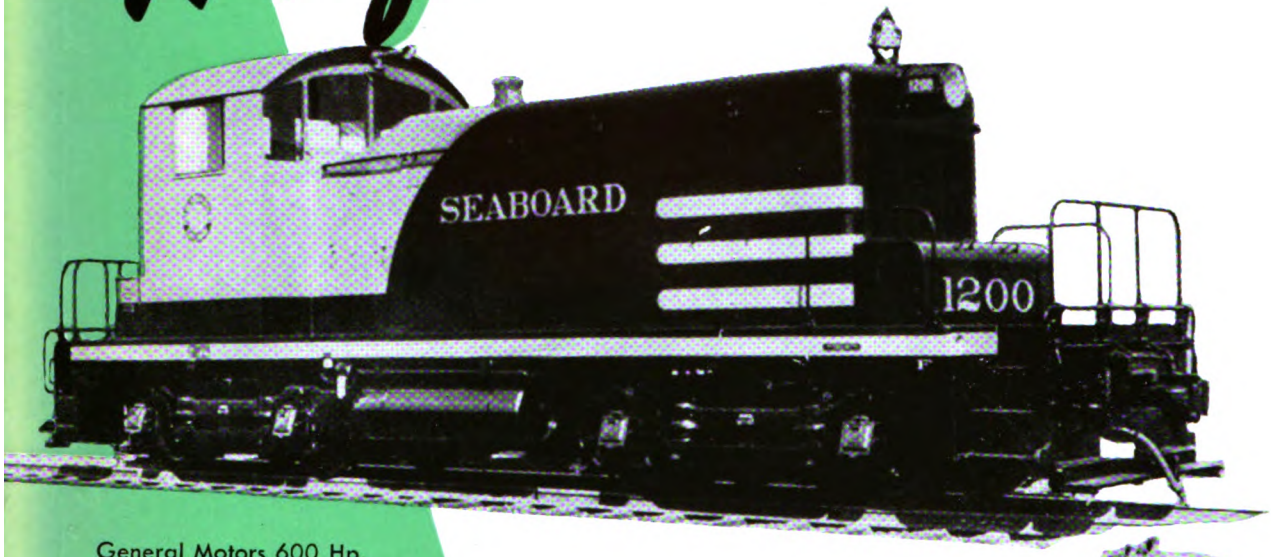
JAMES PURCELL, master mechanic of the Morris and Essex division of the Delaware, Lackawanna & Western at Hoboken, N. J., has been commissioned a lieutenant colonel of the Railway Shop Battalion, United States Army.

H. C. FOSTER, traveling fireman on the Hinton division of the Chesapeake & Ohio, has been appointed road foreman of engines of the Allegheny, Greenbriar and Hot Springs sub-divisions, with headquarters at Clifton Forge, Va.

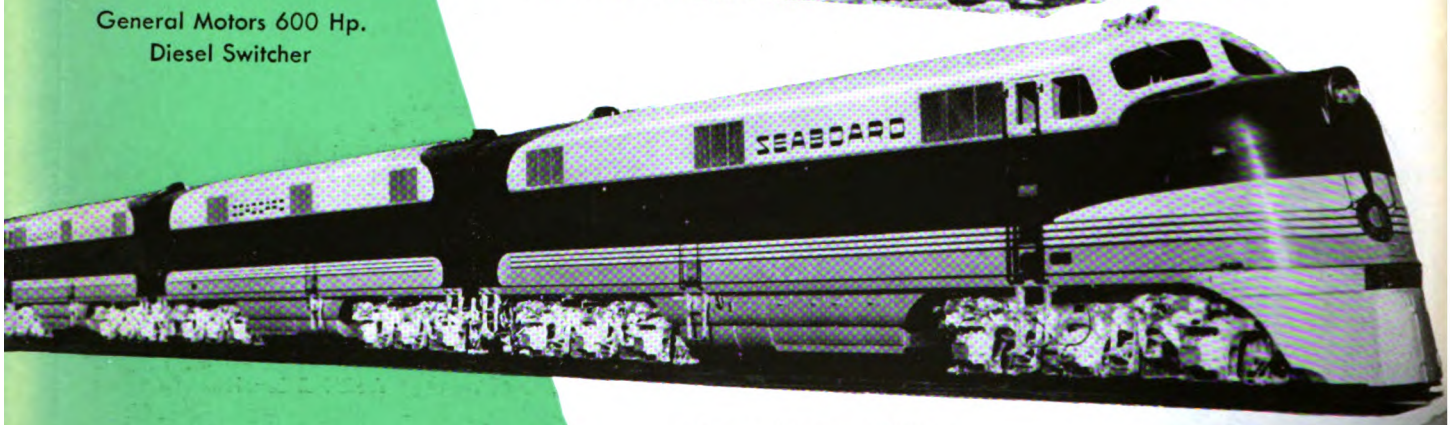
RICHARD DUVAL SMITH, master mechanic of the Interstate Railroad Company at Andover, Va., retired on July 1. Mr. Smith was born on February 5, 1874, at Lynchburg, Va. He attended Bell Heights Academy, Radford, Va., and on May 1,

(Continued on second left-hand page)

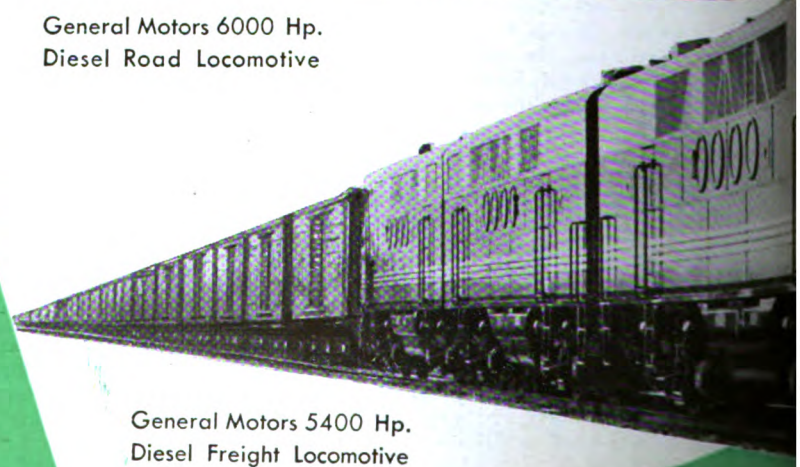
Major Economies



General Motors 600 Hp.
Diesel Switcher



General Motors 6000 Hp.
Diesel Road Locomotive



General Motors 5400 Hp.
Diesel Freight Locomotive

SEABOARD RAILWAY
THROUGH THE HEART OF THE SOUTH

GENERAL MOTORS
LOCOMOTIVES

follow

GM DIESEL EXPANSION

General Motors Diesel Locomotives have definitely established their superiority in switching, transfer, freight and passenger service, providing — reduction in train miles as much as 50 percent — greater tonnage-hauling capacity — higher availability — faster schedules — lower operating costs — increased revenues.

Railroads can now realize ***further major economies*** which logically follow the complete Dieselization of an entire railroad or section of a railroad, such as — fewer locomotives required — fewer terminals required — elimination of costly water-treating plants — water towers — track pans — coaling plants — cinder pits — replacement of large and costly engine-house and backshop facilities with small, modern, efficient but inexpensive maintenance plants.

The ever-increasing displacement of steam power with GM Diesels in all classes of service is a natural process of evolution — **PROGRESS.**

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILLINOIS, U.S.A.



1888, entered the service of the Norfolk & Western as an apprentice. He was subsequently employed as a machinist, assistant foreman, and general foreman until May 1, 1922, when he became master mechanic of the Interstate Railroad Company.



R. D. Smith

HAROLD E. NIKSCH, who became division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific in February of this year, as noted in the April issue, was born on February 1, 1903, at Harvey, Ill. He received the degree of B.S. in M.E. at Armour Institute of Technology, of which he was a graduate in 1924. He entered the employ of the Milwaukee in July, 1924, as a special apprentice and in November, 1927, became mechanical inspector in the test department. He was appointed assistant engineer, budget department, in December, 1930; mechanical assistant, budget department, in February, 1939; special representative to chief operating officer in January, 1941; assistant to superintendent of motive power in April, 1942, and division master mechanic in February, 1943.



Harold E. Niksch

Car Department

B. J. WEISMER, car department foreman of the Delaware, Lackawanna & Western at Secaucus, N. J., has been appointed division car foreman at Hoboken, N. J., with jurisdiction over the Morris and Essex division.

A. W. PHILLIPS has been appointed master car builder of the Savannah & Atlanta, with headquarters at Savannah, Ga.

Shop and Enginehouse

J. K. MILLHOLLAND, general foreman of the Chesapeake & Ohio at Shelby, Ky., has retired.

R. B. SHEPARD, engine inspector in the employ of the Central of Georgia at Macon, Ga., has been promoted to the position of night enginehouse foreman at Macon.

H. H. NIEMEYER, night enginehouse foreman of the Chicago, Burlington & Quincy at Ottumwa, Iowa, has been promoted to acting general boiler inspector, with headquarters at Chicago, succeeding E. G. Staneiforth, who has been granted leave of absence due to illness.

Purchasing and Stores

J. V. MILLER, assistant general storekeeper of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed manager of stores, a newly created position, with headquarters at Milwaukee, Wis.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

DIE STEEL.—Firth-Sterling Steel Company, McKeesport, Pa. Four-page bulletin descriptive of Cromoco air-hardening die steel for cutting and forming dies and for special applications.

◆

MANGANESE STEEL.—American Brake Shoe Company, Chicago Heights, Ill. Forty-eight page illustrated bulletin, No. 543-G, discusses the properties of manganese steel and its applications in various industries.

◆

RIVET HEATERS; FORGING FURNACES.—Mahr Manufacturing Company, Division of Diamond Iron Works, Inc., Minneapolis Minn. Eight-page bulletin illustrates Mahr line of gas- or oil-fired rivet heaters, with specification data. Sixteen-page bulletin, No. 210, descriptive of different types of forging furnaces, with specification data.

◆

"SPRING DESIGN AND ENGINEERING."—Mid-West Spring Manufacturing Company, 4632 South Western avenue, Chicago. Forty-page manual, complete in formulas of spring design and engineering for compression, extension, torsion, flat spiral or motor, flat springs, wire forms, etc., with illustrations, diagrams and tables. Detachable extension sheets follow "blueprint" diagrams, with spaces for details, and sketches for the use of those interested in writing for data on spring problems.

JACKS.—The Duff-Norton Manufacturing Co., Pittsburgh, Pa. Sixteen-page jack maintenance manual, "Maintenance and Safety Hints." Designed as a reference book for mechanical jack users. Describes basic types of mechanical jacks—screw and ratchet types; how they operate, and construction details with diagrams.

◆

ELECTRICAL INSULATING VARNISH.—The Sterling Varnish Co., Haysville, Pa. A four-page bulletin, No. 143, entitled "Thermobonds," describes a new insulation, specifically for high-speed armatures which may be subjected to excessive heat, heavy overloads, and atmospheres containing acid or alkali fumes and abrasive materials.

◆

WELDING ELECTRODES.—Air Reduction, 60 East Forty-Second street, New York. Comparison chart details principal AWS and ASTM electrode classifications and indicates which electrodes produced by 20 manufacturers meet the different requirements.

◆

TWISTITE PRESSURE UNITS AND C-CLAMPS. — Michigan Clamp Company, Jackson, Mich. Bulletin No. 43. Describes Twistite push-pull pressure units, C-clamps, and holding devices of special design into which Twistite units can be build.

◆

BOLT AND WIRE CUTTERS.—H. K. Porter, Inc., Everett, Mass. Forty-eight-page illustrated booklet shows how to get the best results and longest possible service with Porter bolt clippers for the duration—and after.

◆

MACHINE TOOLS.—Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio. Catalog No. M-995-1; 48 pages, illustrated. Engineering specifications on machines for milling, broaching, die sinking, grinding, and lapping.

◆

ARC WELDERS.—General Electric Company, Schenectady, N. Y. Twelve-page bulletin, GEA-1140J, descriptive of operation and advantages of Type WD direct-current, single-operator arc welders. Illustrations show important construction details and both engine- and motor-driven types of welders at work on various jobs.

◆

STANDARD AND SPECIAL DIES.—Carboloy Company, Inc., Detroit, Mich. Thirty-two page cemented carbide die manual and catalog covering standard and special dies for drawing wire, bar, tubing and sheet metal, with detailed recommendations on die shapes for drawing round wire, bar and tubing. Illustrates and lists suggested die-room accessories, supplies and equipment.

◆

"WOOD AND ITS PLACE IN THE WAR EFFORT."—Kay Displays, Inc., 9 East Fortieth street, New York. Spiral-bound book pictures manifold applications of wood and its converted forms to production problems, now for war materials and later for peacetime products. Several case histories are presented, some of which show parts made of bent wood, plywood, and solid wood, engineered and produced in quantities as substitutes for other critical materials.

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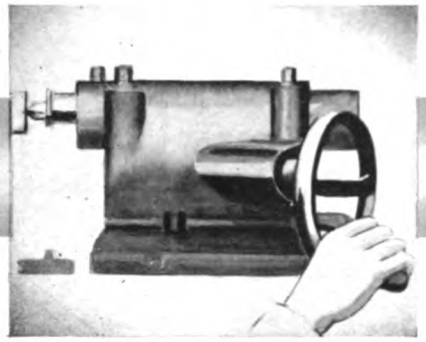
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I'm Tellin' You...

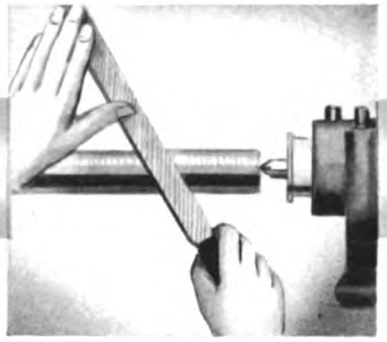
No. 12 in a series on "Keeping 'em Turning" by Charles Carr, 37 years at LeBlond.



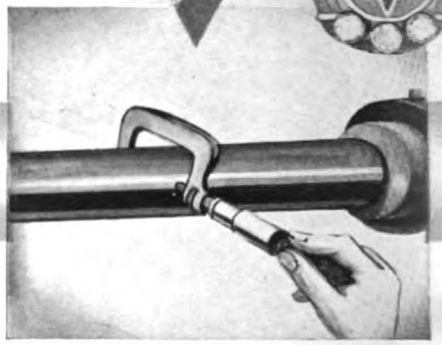
"We old-timers have been passing along the tips on 'Keeping 'em Turning' and we've given you about every important point in the book. But no matter how good a job of turning you've done, it's pretty tough to get a finish smooth enough to be used directly in service. You won't always have a grinding machine available and that's where filing and polishing come in. This is the way an old-timer does it . . ."



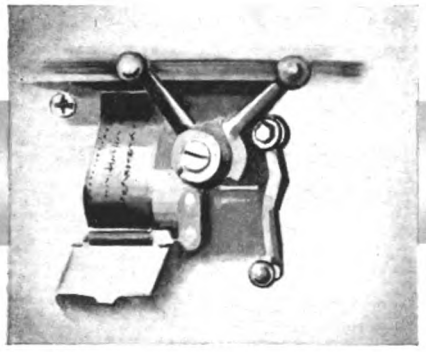
With work set up on headstock center, run tail center up tight, then slack off slightly and start lathe to run at twice finish turning speed, adjusting center to allow dog to click in face plate but not to allow rattle or end shake.



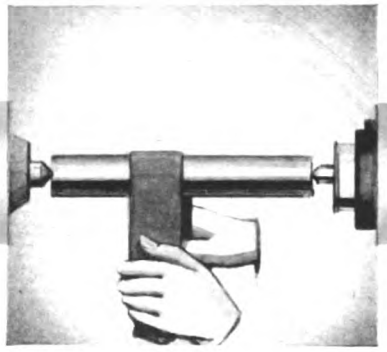
Use a 12-inch mill file with slow, even strokes, lapping from side to side. Use a long, slow forward stroke and press firmly and evenly on the revolving piece being filed. Relieve pressure on return stroke.



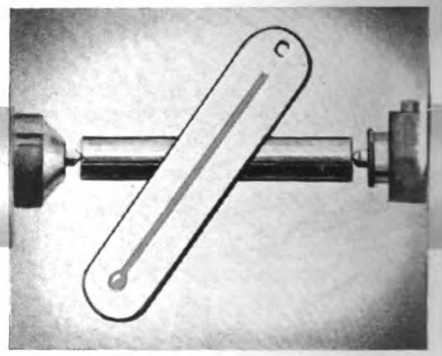
Stop lathe and try diameter with micrometer frequently until whole surface is filed as straight and smooth as possible. Leave from five to eight ten-thousandths (.0005 to .0008) of an inch for polishing the work.



For polishing work that is well-balanced, set change levers to give the highest possible speed. On unbalanced work, run the lathe at highest speed possible without vibration. A speed lathe is best for straight shafts one inch or less in diameter.



Use strip of emery or carborundum paper of fine grade and press against work, moving abrasive cloth from side to side to cross lines and bring work to rough polish without cutting rings. Use very fine abrasive cloth and oil on work for final polish.



Watch out for heat! Remember, polishing and filing heat the work. When measuring with a micrometer, either cool the work by immersing in water or else make an allowance of one or two ten-thousandths of an inch for cooling of work.



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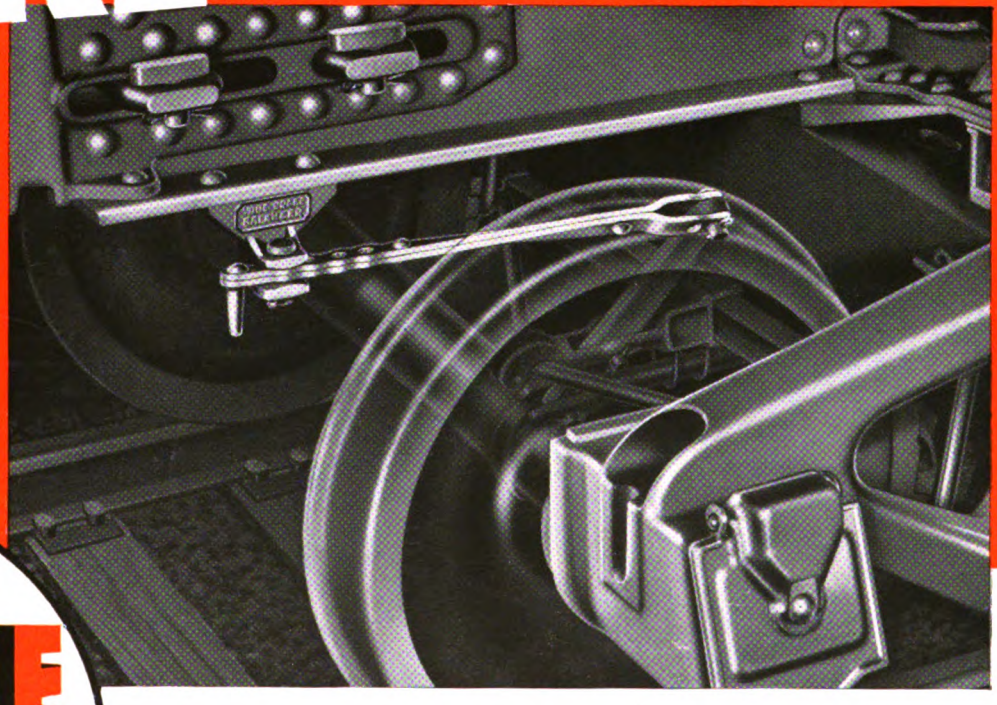
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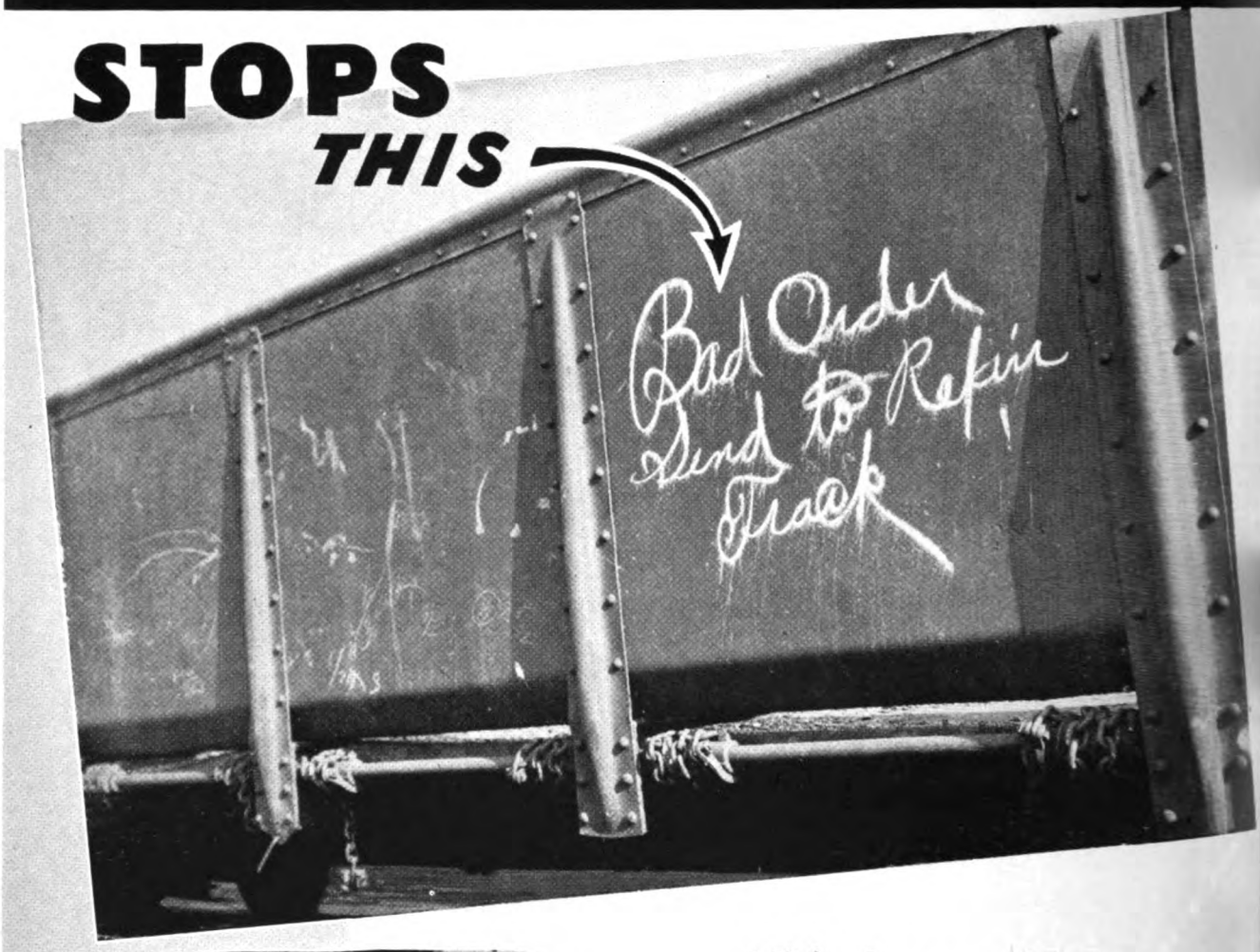
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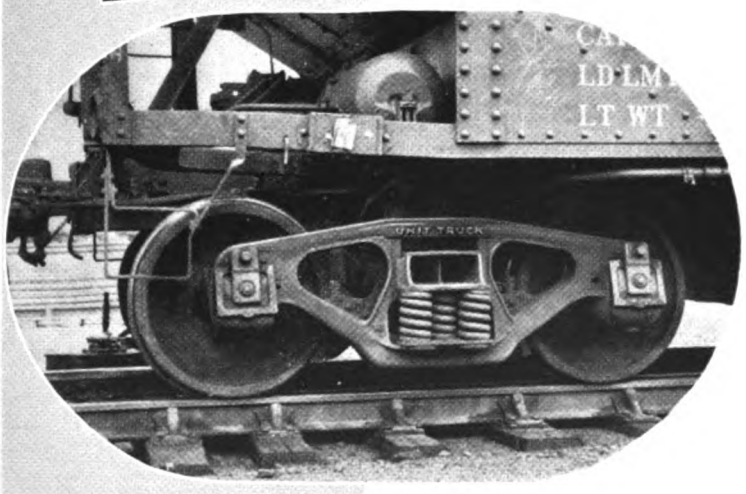
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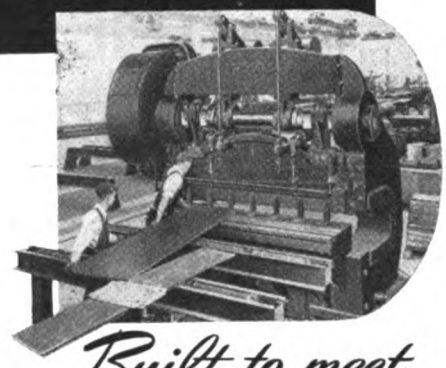
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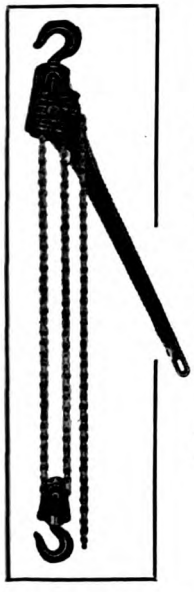
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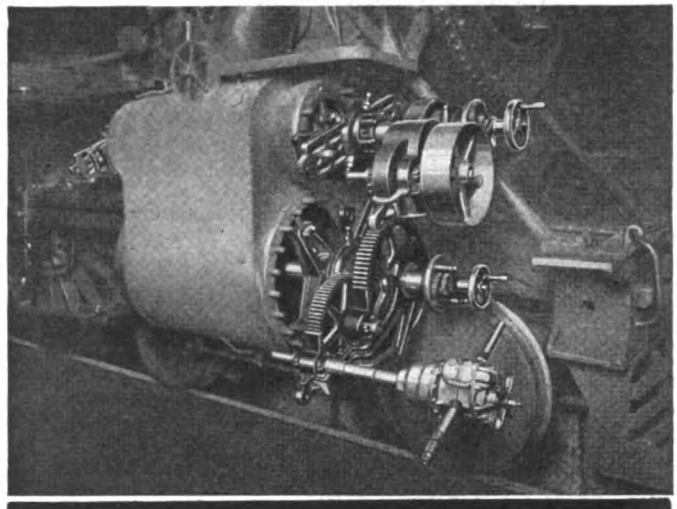
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THE EDITOR'S DESK

PUBLISHERS' PROBLEMS

Critical materials are giving the publishers of newspapers and periodicals much concern. Business papers, such as ours, are being called upon to render all sorts of services, in the editorial and advertising pages, to various governmental projects and agencies which are interested in winning the war. Meanwhile, the compelling needs of the industry which we serve—the railroads and transportation—are such that we are constantly being challenged to render a larger and larger service to our constituency. Then, too, like all other agencies, we are faced with difficult manpower problems within our own organization.

Of the many problems with which we are faced, that of an adequate supply of paper upon which to print the magazine is the most difficult, although it is not the only material that we use that is on the critical list. We have tried to control the situation in such a way that our readers and advertisers would not suffer or be inconvenienced. The size of the type page has been maintained, but the narrowness of the white margins, in reducing the size of the over-all page, has detracted somewhat from the artistic appearance of the paper—and yet, like changes in the styles of women's hats, or the cuffs on men's trousers, we soon became accustomed to the altered appearance.

In the effort to meet the requirements of the W.P.B. we have gone to the use of 50-lb. paper stock, instead of 55-lb., and a still further reduction in the weight will be made when the present supply is replaced. Fortunately our printers have shown special skill in printing on the lighter stock and we are hopeful that, except for the weight of the finished book, the lighter-weight stock will not be unduly noticed.

We have felt that rather than reduce the number of pages in the magazine, the purposes of our readers and advertisers would be better served by making the necessary savings in other ways. We bespeak your patience and co-operation. Rest assured, however, that we shall do our level best to conform to the necessities which confront us and at the same time render a high standard of service to our readers.

Roy V. Wright

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(Name Registered, U. S. Patent Office)
With which is incorporated the RAILWAY ELECTRICAL ENGINEER.

Founded in 1832 as the American Rail-Road Journal

AUGUST, 1943

Volume 117 *No. 8*

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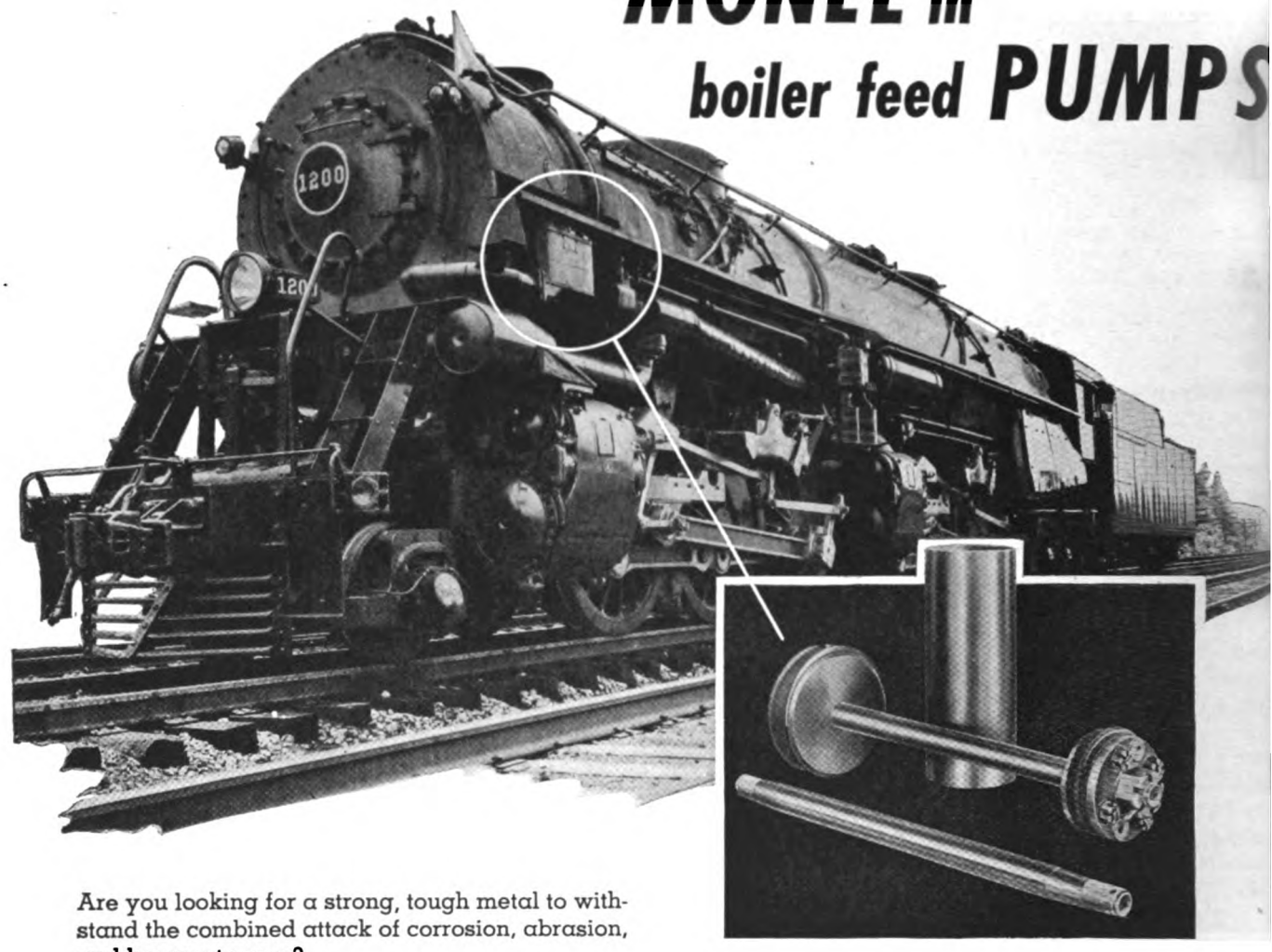
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Erie Trains

Mechanical Supervisors

All supervisors teach—Training of new and up-graded employees emphasized—Job methods training important—Safety record favorably affected — Employees interested

As a part of its continuous training program the Erie adopted a program formulated by the Training Within Industry Division of the War Manpower Commission for use in instructing its supervisory personnel in better methods of teaching the employees under their jurisdiction the most effective way to carry out their assigned duties. The instruction will be given to all men holding supervisory rank in the mechanical department as well as to supervisors in the various other departments of the road's organization. The instruction is also being followed by further training for supervisors in the study of job methods, a recommended program of the Manpower Commission.

In its essentials the program follows successful methods of foremanship training used in other fields but departs from the ordinary in the use of a skeletonized training manual and in dependence upon a series of charts to stimulate discussion in conference groups which are limited in size to permit the full participation of all members. Four main subjects are covered: (1) how to teach a man to do a job; (2) how to handle questions, objections or grievances; (3) how to encourage and maintain enthusiasm; and (4) how to teach a person to do a job safely. Other subjects are to follow.

The conference group sessions for executives and key men from the various departments and divisions on the railroads are conducted by the educational director of the Erie at its home office at Cleveland, Ohio. Approximately 225 of these men have been trained and many of them are now serving in the teaching force which carries on the training schedules at various points on the road for other supervisors. Included among the teachers who have been trained in the Cleveland training conferences are division superintendents, shop superintendents, master mechanics, general foremen, division car foremen, track supervisors, division engineers, passenger agents, general freight agents, claim agents, and accounting and clerical supervisors. Classes are held wherever groups can be assembled most conveniently and arrangements are made to insure that no one in a supervisory capacity will fail to receive the instruction.

How to Teach a Man to Do a Job

Although all subjects taught have a definite place in the training program on the Erie, the most important at present in all departments, particularly in the mechanical department, appears to be the training of supervisors in teaching men to do a job. To accomplish this purpose, training is given in the "sure-fire" method of getting a man to do a job safely, correctly, quickly and conscientiously.

Practical class demonstrations are used to illustrate the fact that merely telling a workman how to do a job is not enough to insure successful performance. Additional demonstrations clearly prove that showing alone is not a satisfactory method of teaching a learner to understand the work required of him. Throughout all lessons it is constantly emphasized that, "If the learner hasn't learned, the teacher hasn't taught." Preparation for instruction is stressed because it is believed that it is as important that a teacher know how to get ready to instruct as it is actually to teach. The preparation of a job break-down sheet is an essential part of the Erie method. The principal steps of any operation are listed on this sheet, together with the key points to be stressed

ERIE JOB BREAKDOWN SHEET

Name of Job: Assembly of E7 reducing valve

Purpose of Job: To limit brake cylinder pressure

Important Steps	"Key Points" - knacks, hazards, "feel", timing, special information
1-Body in left hand	Large opening up
2-Apply regulating nut to body	Lip down Screw down until lip reaches 3/32-in. hole in body
3-Apply jam nut	Screw hand tight against regulating nut
4-Apply valve to seat in valve body	Valve seat down, use hair pin spring holder to guide valve into valve body
5-Apply valve stem	Connection end seated in countersunk hole in valve
6-Apply spring over valve stem	
7-Apply adjusting nut	Hex end up, insert first finger of left hand in hole at bottom of valve body and raise off its seat about 1/4 in. Then enter valve stem into regulating nut screw nut down hand tight
8-Apply cap nut to adjusting nut	Screw all the way down hand tight

A breakdown sheet prepared for use in a class group—Similar sheets are now being prepared for each repetitive shop operation

during training. This sheet serves as a guide to the instructor and is not given to the learner. Its use leaves little likelihood that any step required in the correct performance of any task can be overlooked, and a trainee handicapped by his supervisor's oversight.

Tell-Show-Repeat-Discuss-Check

The essential features of the "sure-fire" method are simple. A learner must first be told how to do a job, then shown; then told and shown until the instructor feels satisfied that the learner has absorbed all that is necessary to perform the job in a satisfactory manner. When this point has been reached the learner must demonstrate his ability to the satisfaction of the teacher, being corrected immediately if he makes an error.

It may be necessary for the instructor to repeat again and again and have the learner make a number of attempts until there is a successful performance. Repetition of the performance by the trainee should be required until the instructor is sure that the job is thoroughly understood and that continued correct results will be obtained. In no case should the word of the learner be taken that he understands; the teacher must know that the learner knows. Discussion of any problems involved often speeds learning by clearing up doubtful points immediately in the learner's mind. Even after putting a new man on his own, occasional checks should be made by the teacher to be certain that the desired level of performance is being maintained.

Has It Worked?

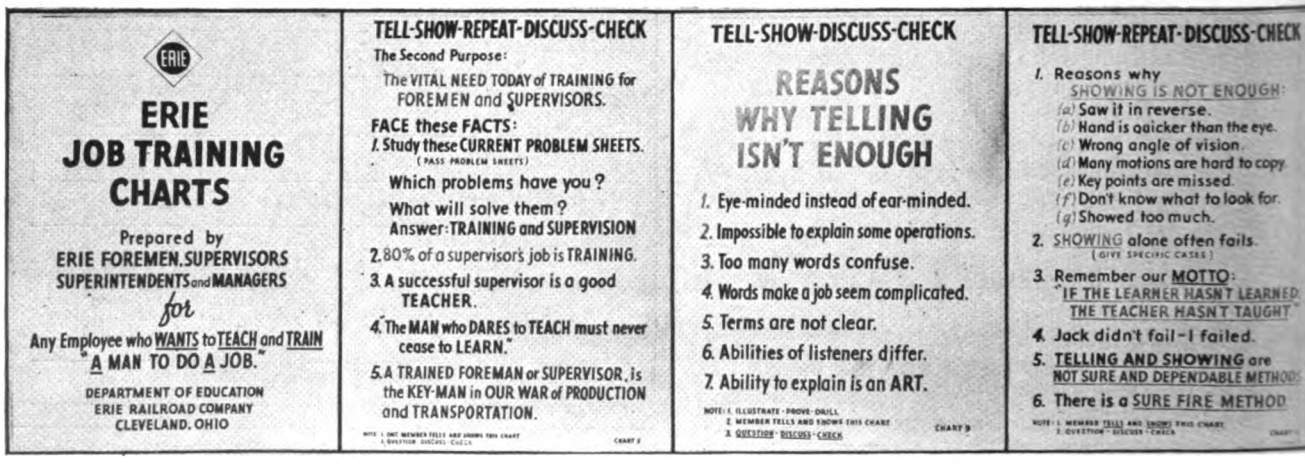
This brief summary of the job instructor phase of training leads naturally to the question of determining the effect which the program has had in the training of mechanical personnel. It is difficult to evaluate the worth of the program in terms of increases in shop output, reduction in pre-unit cost of production, or improvement in quality of workmanship. The training of supervisors in instruction methods has had a part in and will continue to affect all of these factors. Particularly evident, however, is a toning up of the entire shop personnel, foremen and workmen, at each of the points which were visited. Men appear to be interested in their work and in the best methods of performing that work.

Among the concrete instances which can be cited is that of a mechanic who finished his apprenticeship and served until 1924 on the erecting floor at one of the Erie's locomotive shops. In his apprenticeship course this man had had no machine experience; at that time it was customary to distinguish between "floor men" and "machine men." In 1924, this man left the service of the Erie and was employed for 18 years as a chauffeur in a private family and so might have been expected to have lost all railroad mechanical skill. After his return



The machining of stoker screws reclaimed by welding is facilitated by the use of a multiple-head tool holder suggested by a shop employee

to service, he received training under the principles incorporated in the job instructor training course and within a period of six weeks had qualified as a capable and efficient operator on a wheel lathe, journal lathe, 48-in. engine lathe, slotter, 42-in. boring mill, No. milling machine and a shaper. His instructors on each of these tools were shop mechanics who had had instructor training passed on to them by their foreman. At the end of six weeks, this mechanic was being assigned work on his own responsibility on certain shop operations being performed on the night shift. He was work without the immediate supervision of any leader or foreman. The shop superintendent was confident that the man's work would be good and stated that the



Representative charts used in teaching supervisors how to teach others

principles of the training program were primarily responsible for the short time in which this mechanic had been prepared to assume his duties.

Mechanics Are Learning Method

It was interesting to note that the principles of the training program are being passed along to shop mechanics who are responsible for the training of apprentices in the use of various machine tools and the performance of varied shop operations. Conversation with a number of them disclosed that they found it easier to train apprentices assigned to them and that the apprentices themselves responded more quickly to the tell, show, repeat, discuss and check system. It was also plain that the apprentices found this method of instruction far superior to the one more commonly employed in which the mechanic had the attitude "watch me and you're dumb if you can't learn." One apprentice who had been given the opportunity to take the complete course along with a number of foremen and shop mechanics and who looks forward to some day becoming a supervisor himself felt that his apprenticeship training had been more valuable and his prospects of success later improved. Other apprentices felt that they were making more rapid progress because of the application of the training principles by their instructors.

Job Breakdown Sheets

Another effect which the program has had in the shops of the Erie has resulted from the use of job breakdown sheets in the training class groups. The various shops are now preparing and filing for use job breakdown sheets on all operations which are more or less repetitive in the repair and maintenance of motive power and rolling stock. This job study is resulting, in many instances, in a simplification of procedures and in the standardization of work methods. The principle of standardized procedures is not new but the study involved in the preparation of the breakdown sheets for instruction purposes has revealed that the practice was not being followed out as fully as it might have been.

Many of the mechanics are now initiating ideas for better production methods because of the general interest being displayed in the shops, especially in the study of machine-tool operations. In fact, hundreds of suggestions have been received from shop employees as a result of the encouragement given them to participate in the development of better procedures. Many of these have been adopted and have materially affected either the quantity or quality of output. Every idea received is given careful consideration by those responsible for shop production and a very high percentage of the suggestions made have proved to be useful. Many of the men present their ideas worked out in detail, others call attention to possibilities for applying new methods but find it necessary to rely on other workmen or foremen for assistance in developing their suggestions.

Typical of the suggestions adopted are the following: a portable boring bar arrangement for machining the sealing ring on stokers; improvements to automatic devices in use in the flue shop; an automatic set-up which has speeded the sharpening of circular saws; a steady rest for a milling-machine arbor when two cutters are being used; a change in design of a whistle shield which required less material and lowered the cost per unit; wooden templets for use with a gas-cutting machine; changes in a monorail crane system to expedite material handling; a device for applying valve chamber bushings which uses a 35-ton journal jack supported by rods and a plate fastened in place on the valve-chamber studs; a sand-blast unit for cleaning the inside of angle-cock caps; a rack for the storage of pistons, and a set-up for machining stoker screws built up by welding.

Job Methods Training Program

It is expected that even more of these suggestions will be forthcoming as the effect of the job methods training program now being given reaches all shops on the railroad. Careful study of all details of present methods of work performance is followed by the development of better procedures through the elimination of unnecessary details, the combining of operations when possible, the rearrangement of tools, machinery, work benches, etc., when necessary to achieve better results, and the simplification of every detail possible. Foremen who have already concluded their work in job-instructor training are finding this additional program is equally valuable in meeting present day demands in the shops.

New Personnel Trained

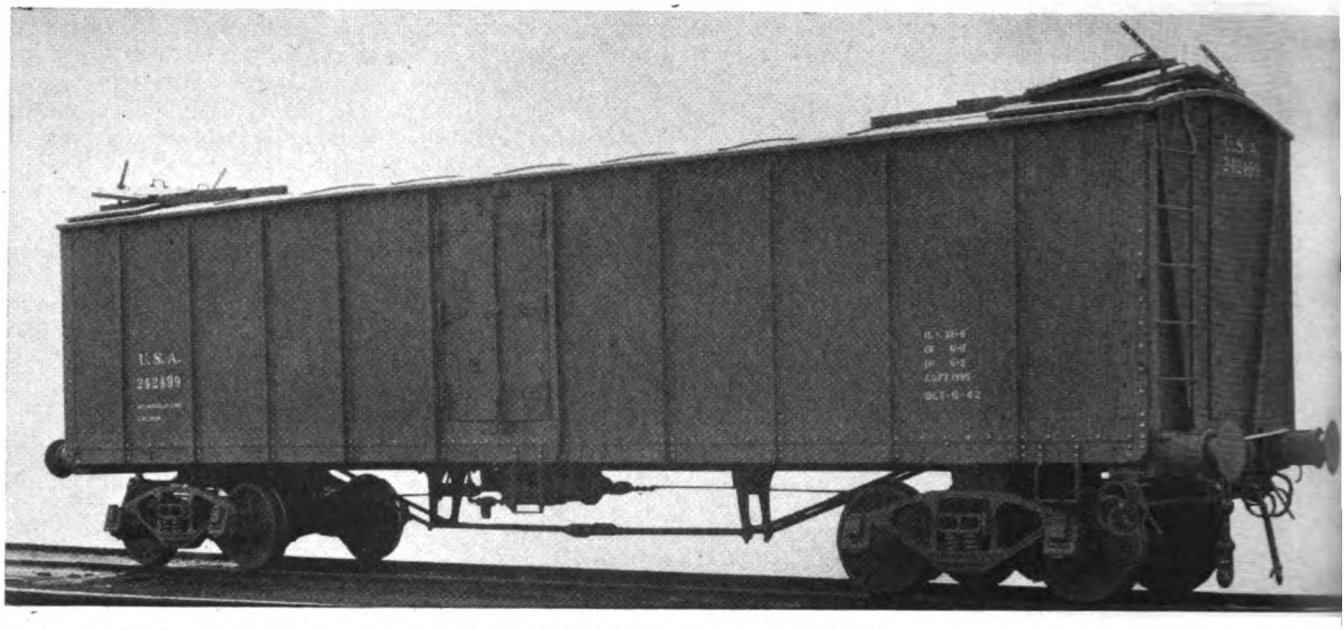
New employees in the mechanical department are being hired monthly at the rate of approximately six per cent of all employees in the department. The absorption of these new employees into the working force and the training of workers assigned to new duties is done in accordance with the instruction steps of job instructor training. No additional burden is placed upon supervisors because the training program assures good results in the development of competent workers.

Safety

The application of the principles of job instructor training has helped greatly in the training of new men and old employees in the safe performance of their duties. Although safety had been stressed before the new training schedules were devised it has been found that "Sure-Fire" safety instruction tends to form safe working habits at the beginning of a man's employment.



Sharpening of circular saws has been speeded and the cost of the operation considerably cut as the result of the thoughtful interest in his work displayed by the employee photographed with a set-up which he devised



Plywood-sheathed, steel-framed refrigerator car built for the War Department for foreign service

American Car and Foundry Company Builds

Plywood Refrigerator Cars

Steel framed design using plywood for sides, ends and roof lining was built for foreign service — Cars have conventional trucks and brake equipment

THE American Car and Foundry Company recently completed at its Chicago plant an order of 200 refrigerator cars of steel and plywood construction designed for the War Department for foreign service.

The underframes of these cars are of all-steel construction with center sills consisting of 31.3 lb. Z-sections; side sills 9-in., 13.4-lb. channels, and end sills of $\frac{5}{16}$-in. pressed steel. The center sills are further reinforced by two 1¾-in. truss rods under the sills. The bolsters are fabricated pressed-steel assemblies with built-up welded center fillers. The cross-bearers likewise are of pressed steel with top and bottom cover plates. The floor supports consist of 6-in. channels, wood floor nailers, with a $\frac{25}{32}$-in. sub-floor, 1¼-in. tongue-and-groove main flooring, and 2½-in. Fiberglas floor insulation. The conventional floor racks of wood extending from bunker to bunker are a part of the construction. The cars have cast-steel buffers, with drop-forged European-type screw couplings and Cardwell-Westinghouse type D-10 draft gear.

The Superstructure

The superstructure framing consists of $\frac{3}{16}$-in. pressed-steel side posts; 3-in., 6.7-lb. Z-section door posts, and 3-in. angle corner posts. The end braces are 3-in., 5.1 Z-sections. The carlines consist of 4-in. by 3-in. angles with $\frac{3}{16}$-in. pressed-steel roof flashing, and a roof ceiling of $\frac{3}{8}$-in. plywood. The inside side sheathing and inside end sheathing are also of plywood of the same thickness. Plywood, ½ in. thick, is used as the outside side and end sheathing.

Fiberglas insulation is used throughout, with a thickness of 4 in. in the roof and 3 in. in the sides and ends that in the floor being 2½ in. The floor insulation i continuous from bunker to bunker between the sub- an main floors. The side and end insulation is in panels se in between the horizontal and vertical nailing strips. Th roof insulation, likewise, is in panels, located betwee the ridge-pole and side-plate wood furring. The joint between the plywood panels on sides, ends, and roof ar covered with wood battens. Divided ice bunkers wit flexible ice pans are part of the equipment.

The side doors of these cars are the 4-ft. refrigerato type door with Miner fixtures. There are bunke hatches at the four corners of the roof fitted with Aze fittings.

Trucks and Brake Equipment

The trucks under the cars are the 40-ton capacit spring plankless type, having cast-steel side frames an

(*Continued on page 355*)

roblems of

Reducing Boiler Explosions*

By Ray McBrian†

Educating enginemen as to the effect of grade on water level—Search for a steel which retains more strength at high temperatures

Boiler explosions, as so termed on railroads, are enerally due to overheating of the locomotive fire-ox crown sheet under low-water conditions. There are ther causes which occur at rare intervals, such as break-ge, defective material, corrosion-fatigue, strain aging nd, as in the case of stationary boilers, intergranular mbrittlement.

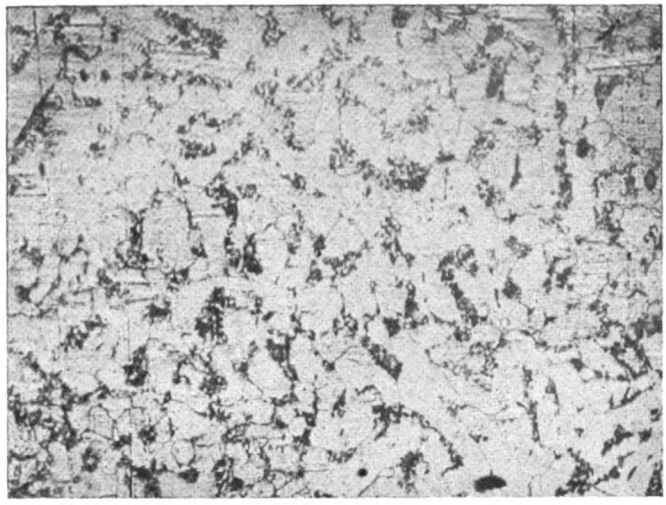
In the February, 1943, issue of the *Railway Mechan-al Engineer*, John M. Hall, director of the Bureau of ocomotive Inspection, called attention to the increases n boiler explosions which had occurred since the last scal year of the bureau as closed on June 30, 1942. eventeen such explosions had occurred since last July 1, hich resulted in the death of 14 experienced enginemen, remen and trainmen, and serious injury to 46 others. Ie stressed the importance of enginemen and firemen eing alert with respect to the water level in the loco-notive boiler.

Boiler Model Helps in Educational Campaign

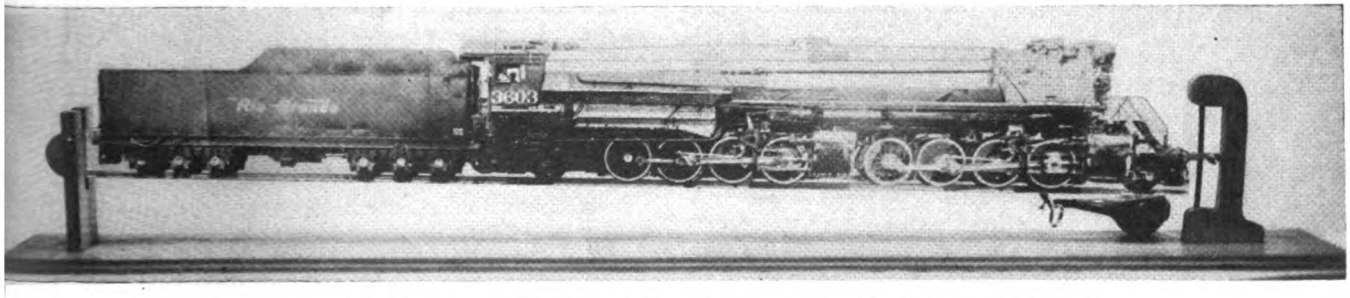
In connection with an educational campaign, the Den-er & Rio Grande Western has constructed and is using hollow model of a locomotive boiler so that enginemen n this road may actually see what happens to the water evel in a locomotive on changing grade. The model is pproximately 3½ ft. long, and made from plywood and elluloid. A side view photograph of a locomotive was nlarged, as shown in one of the illustrations, to the desired ize, and pasted on ⅝-in. plywood. The outline was cut ut and the resulting engine mounted on a pivot so that it an be set to any grade from plus four to minus four er cent. An outline scale model of the upper half of he boiler was built from 1/16-in. celluloid glued with cetone. The boiler is complete with crown sheet, brass ods for the upper flues, steam dome and water glass. Outlines of the dry pipe and fountain pipe are pasted n proper location on the rear. A large rubber bulb with hose connection and pinch clamp, connected to the oiler, allows variation of the water level in the boiler. A table of ruling grades is pasted on the base, together with operating instructions.

It is the intention to have each engineman individually inspect and operate the model to see the effect of grade on water level.

In addition to this type of educational campaign, investigations as to improvements in materials and the effect of syphons as added safety factors are being studied. In fact, the purpose of this paper is to discuss briefly one phase of metallurgy which may not be generally understood, namely the effect of temperature on the strength of materials, and to suggest that by the use of a steel with greater strength at high temperatures in combination with syphons, an added factor of safety is introduced. The study of an explosion which occurred on the D. & R. G. W. some time ago, and of a low water condition which resulted only in the bagging of such an



Microstructure (200 diameters) of crown sheet near the point of failure



Locomotive model which shows changes in the level of the water in the boiler on varying grades

* An abstract of a paper presented at the annual meeting of the Asso-iation of Railway Claim Agents held June 16 at the Hotel Sherman, Chicago.

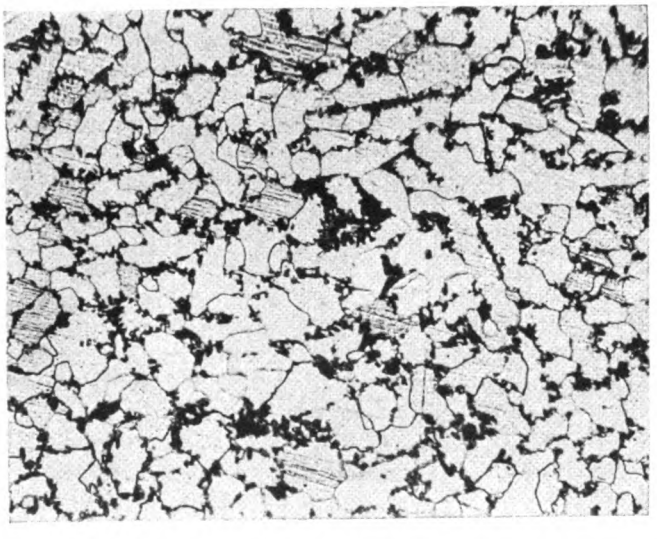
† Engineer of standards and research, D. & R. G. W., Denver Colo.

alloy steel in a locomotive equipped with syphons, brought out these facts very forcibly.

It should be understood that, at room temperature, metals behave similarly to a rubber band, increasing in length when a load is applied, and returning to their original length when the load is removed. This increase in length is directly proportional to the load applied, for loads within the elastic limit of the metal.

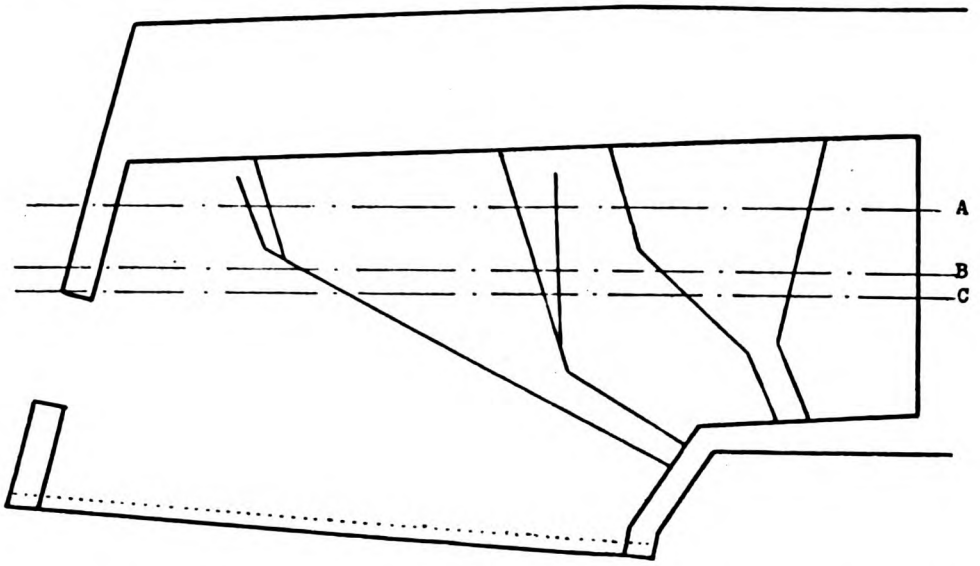
At high temperatures, the behavior of metals is different. When loaded, they increase in length and the stretching continues at a fairly constant rate, eventually increasing with reduced section until failure occurs. This reduction of section, or stretching of metal, is found when overheating occurs, and in our investigation of the explosion mentioned, this was the case. Metallurgical examination was made of the failed material under the microscope.

The microstructures found at various locations around the firebox showed that maximum temperature was reached at a point coincident with the origin of the explosion and established that the maximum temperature had been between 1,350 and 1,400 deg. F.



Microstructure of comparative piece of a crown sheet heated to 1,350 deg. F.—Comparison with the structure of the failed crown sheet indicated that the failure had occurred at 1,350 to 1,400 deg. F.

Another illustration shows the miscrostructure of portion of the crown sheet which had been heated this temperature. For comparison, pieces of the crow sheet were heated to 1,350 deg. F., 1,650 deg. F., a



Sectional drawing showing various water levels at which syphons continue to function

to 1,800 deg. F., as shown in the three other micr photographs.

The effect on the microstructure of heating to th different temperatures is shown, and by the comparis with these photographs the temperature to which t

Results of Comparative Tests of Two Steels at 1,385 deg.

	Tensile strength, lb. per sq. in.	Elongati per cent in 1 in.
A. A. R. carbon firebox steel	5,600	98.5
A. S. T. M. A.-204 firebox steel (Carbon-molybdenum)	13,400	128.0

Using formula $S = \frac{Pa^2}{4\ T^2} = 8{,}000$ lb. per sq. in.

Where S = maximum working fiber stress, lb. per sq. in.
P = boiler pressure, = 280 lb. per sq. in.
a = staybolt pitch = 4 in.
T = thickness of plate = 3/8 in.

crown sheet had been heated was determined. T structure obtained by heating to 1,350 deg. F., w almost identical to that shown in the crown sheet samp All of the micrographs were made at 200 diameters.

Carbon-Molybdenum Retains High Strength at High Temperatures

To determine the strength of the crown sheet at t temperature at which it failed, tensile tests were ma at 1,385 deg. F. Tensile tests were also made of ca bon-molybdenum firebox steel at this same temperatu for comparison. The molybdenum content of the fir box steel was 0.50 per cent. The results of these te are given in the table.

They indicate that the tensile strength of the crow sheet where it failed was approximately 5,600 lb. p sq. in., or only one-ninth the value at room temperatur The carbon-molybdenum firebox steel at this temperatu had a tensile strength of 13,400 lb. per sq. in., or mo than double the strength of plain carbon steel. T demonstrate that the reduction in strength due to ove heating alone could cause the failure of this firebo the calculations were made, using the formula show under the table. A 3/8-in. plate and a staybolt pitch of

give a working stress of about 8,000 lb. per sq. in. for lb. boiler pressure.

rom the high temperature tests, it was shown that the plain carbon steel the strength at 1,385 deg. F. s only 5,600 lb. per sq. in., or 2,400 lb. per sq. in. er than the working stress at that temperature. It s found then that the boiler pressure alone was suf-ent to cause failure when the temperature of the crown et approached 1,350 deg. F. Also it was found that molybdenum steel, due to its higher strength, would have failed at this working stress and the tem-ature of 1,385 deg. F. which was reached in the wn sheet.

The effect of the use of such alloy steels is to pro-e an additional factor of safety through the strength-ng of the steel at the higher temperatures. Along h these metallurgical studies, a test was made on scale model firebox to show the action of syphons der low water conditions. The model was one-eighth le of a locomotive equipped with five syphons, three the firebox and two in the combustion chamber. The t demonstrated that the syphons will function after water level is below the crown sheet and that the ebox syphons function after the combustion chamber phons have ceased to discharge water over the crown eet. The results of this test are given in a sectional awing which shows that when the water level *A* was ched, the top row of tubes adjacent to the back flue eet became dry. When the water level was at *B,* part the crown sheet in the combustion chamber and next flue sheet became dry. When the water level reached most of the crown sheet in the combustion chamber came dry. But the firebox syphons continued to action.

Such investigations aid in securing better materials d in preventing the occurrence of explosions, but, as ted editorially in the June *Railway Mechanical En-neer,* enginemen persist in trying to restore low water face of extreme danger, which leads to the follow-g questions:

"Are enginemen generally aware of the extremely rrow margin of time in which they can be sure of fety after the water first disappears from the bot-tom of the water glass, and also how many railroads have formulated definite rules of action embodying safe procedure to be followed when low water emergencies present themselves?"

Such questions are pertinent as well as the studies to improve materials and appliances, and warrant a continual definite campaign and vigilance to prevent low-water explosions.

Plywood Refrigerator Cars for War Department

(*Continued from page 352*)

double-truss lightweight cast-steel truck bolsters. The center plate and dead lever stop bracket are cast integral with the bolsters. The trucks are equipped with 5-in. by 9-in. A. A. R. "emergency" axles and 33-in., 610-lb. chilled-iron wheels.

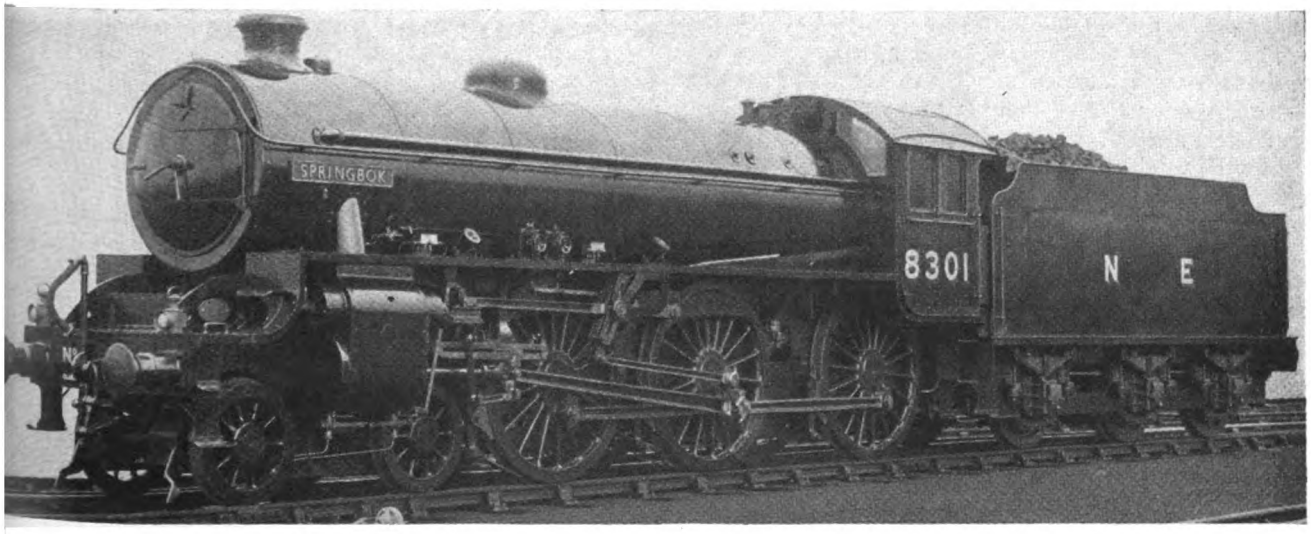
The brake equipment consists of Westinghouse KC-1012 equipment with 86-second choke fitting. The hand brake shaft is in the horizontal position with hand brake wheel, pawl and ratchet below each side of the car under the same end.

The general characteristics are shown in the table.

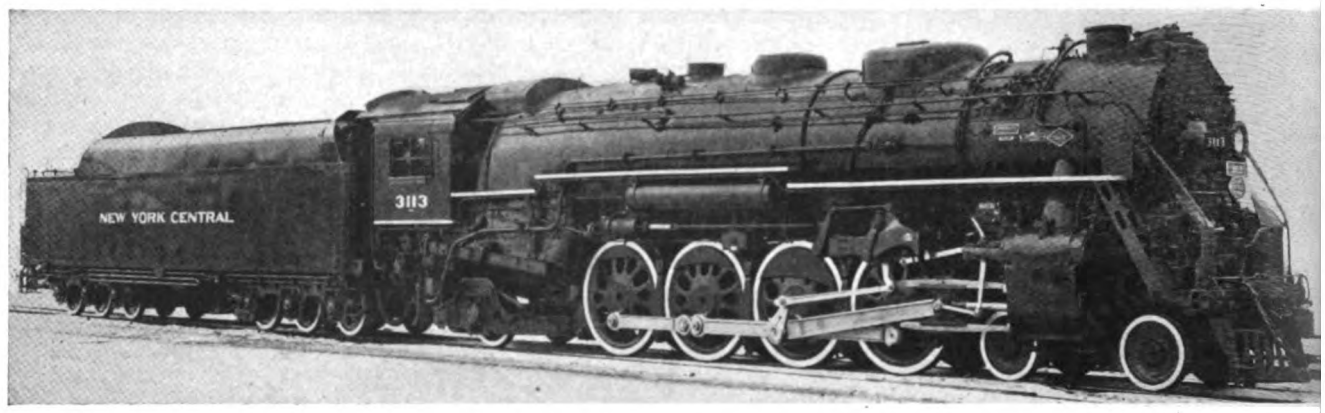
General Characteristics of the U. S. Government 35-Ton Refrigerator Car

Length over buffers, ft.-in.	43— ¼
Length over end sills, ft.-in.	39— 5
Length between truck centers, ft.-in.	29— 5
Length between ice bunker bulkheads, ft.-in.	32— 8
Width inside, ft.-in.	6—11
Width over side plates, ft.-in.	8— 2
Width over side sills, ft.-in.	7— 6¼
Height floor to ceiling at center line of car, ft.-in.	6— 9⅞
Height rail to top of roof battens, ft.-in.	11—10⅜
Height rail to top of floor, ft.-in.	4— 7
Height rail to center of buffer, ft.-in.	3— 6
Height rail to center of drawbar, ft.-in.	3— 6
Height weight, lb.	39,900
Gauge of track, ft.-in.	4— 8½
Capacity, tons	35

* * *



4-6-0 locomotive built for heavy passenger and fast freight traffic on the London & North Eastern—The locomotive, designed for service ywhere on the system, has a tractive force of 26,878 lb.; a boiler pressure of 225 lb.; 20-in. by 26-in. cylinders; 74-in. driving wheels, d a weight in working order of approximately 276,000 lb.—All steel castings other than wheel centers, buffer sockets and horns have en eliminated in its construction—The "Springbok" is the first of a series to be known as the Antelope class



New York Central

All-Round Road Locomotives

Built by Lima, primarily for freight service, these 4-8-2 type have 72 in. drivers and develop 59,900 lb. tractive force—Drawbar horsepower estimated at about 4,300 at 60 m.p.h.—Entire group has averaged over 10,000 miles per month since delivery

THE New York Central received 25 4-8-2 type locomotives from the Lima Locomotive Works, Inc., during the period from December 1 to March 4. These locomotives, known as the L-4a class, are the same as the L-3a class, 50 of which were delivered to the railroad beginning in December, 1940, except that the diameter of the driving wheels has been increased from 69 to 72 in. and the diameter of the cylinders from 25½ in. to 26 in., so that there is no appreciable difference in the tractive force of the two types. Since the delivery of the first of these locomotives they have accumulated 1,257,717 miles up to the first of June, with an average of 10,681 miles per locomotive per month.

In a road test one of the L-3 locomotives developed a maximum indicated horsepower of 5,260 and a maximum drawbar horsepower of 4,120 at 58 m. p. h. The L-4's have not been tested, but it is estimated that they will develop a maximum of 5,400 i.hp., and of just under 4,300 db. hp. at 60 m. p. h.

The L-3 class locomotives, 25 of which were equipped so that they were available for both freight and passenger service, demonstrated their capacity to handle heavy passenger service at fast schedule speeds. The new locomotives with their larger drivers are even better adapted for this service. They are a universal road service type.

These locomotives were ordered in February, 1942, and their design was, therefore, not subject to the full impact of the shortages of critical materials which developed rapidly following our entrance into the war. A number of substitutions were called for, however. These included the substitution of steel tubing for copper tubing, the replacement of the bronze bell by a welded steel bell, and the use of steel in the construction of the cab and in the running boards. Aluminum had been used for the cabs and running boards of the L-3 locomotives. This substitution is largely responsible for the increase in the weight of the locomotives of the L-4 class.

The boilers are of the conical type. The firebox has 75.3 sq. ft. of grate area and a 63-in. combustion chamber. The tubes are 20 ft. 6 in. long. Although they ar operating at a working pressure of 250 lb., they are d signed for a pressure of 255 lb. This pressure was al the basis of the machinery design.

Boiler Construction

Both firebox and boiler plates are of the basic ope hearth steel. The first shell course is of $^{15}/_{16}$-in. pla while the second and third courses are $1^{1}/_{32}$-in. pla The inside firebox is of welded construction throughou The sheets are laid out so that the grain structure the crown and sides runs longitudinally; the combusti chamber below the crown, circumferentially, and the i side throat sheet, horizontally. The bottom of bo inside and outside firebox sheets are welded to t mud rings at the corners.

The calking edges between the back head and wrapp sheets are electric welded for a distance of about 29 i up from the mud ring. The circumferential seam b tween the rear shell course, the wrapper sheets, and t throat sheet, and between the throat sheet and wrapp sheets are seal welded. The usual seal welding is al applied at the ends of the longitudinal joints in the boil shell courses.

There are four 2-in. combustion tubes through each de of the firebox.

The boilers are fitted with the Type E superheater nd have the Worthington SA feedwater heater. The reboxes have Firebar grates and are fired with the tandard HT type stoker with the engine mounted on ıe tender. The boilers are fitted with the National luminite blow-down system.

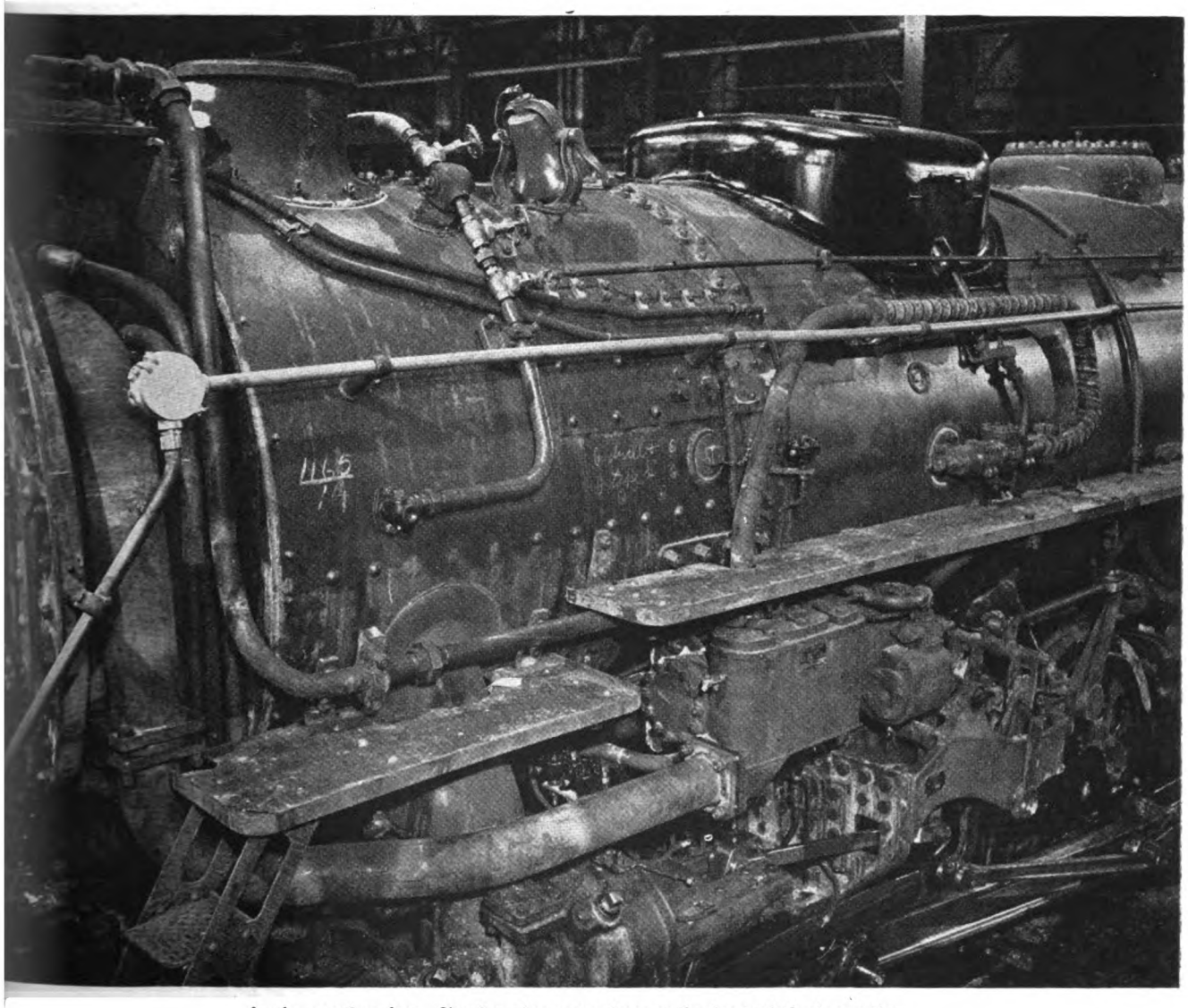
Foundation and Running Gear

The foundation of the locomotive is a General Steel astings engine bed in which the cylinders, the back linder heads and air-pump brackets are an integral art. On 20 of the locomotives the driving wheels are oxpok castings and on five, Scullin disc wheels. The xles are all hollow-bored. The driving-axle journal earings are Timken double-roller type mounted in split ousings. There is an end play of $\frac{3}{16}$ in. on each de between the driving boxes and the pedestal shoes nd the Alco lateral cushioning device provides for $\frac{1}{2}$ in. ontrolled lateral on each side of the front box and $\frac{5}{16}$ i. on each side of the main boxes. The cushioning de- ice is set for a resistance of 17 per cent of the weight t the rail on the front boxes and 8 per cent on the ain boxes. Spring hangers are conventional gib types.

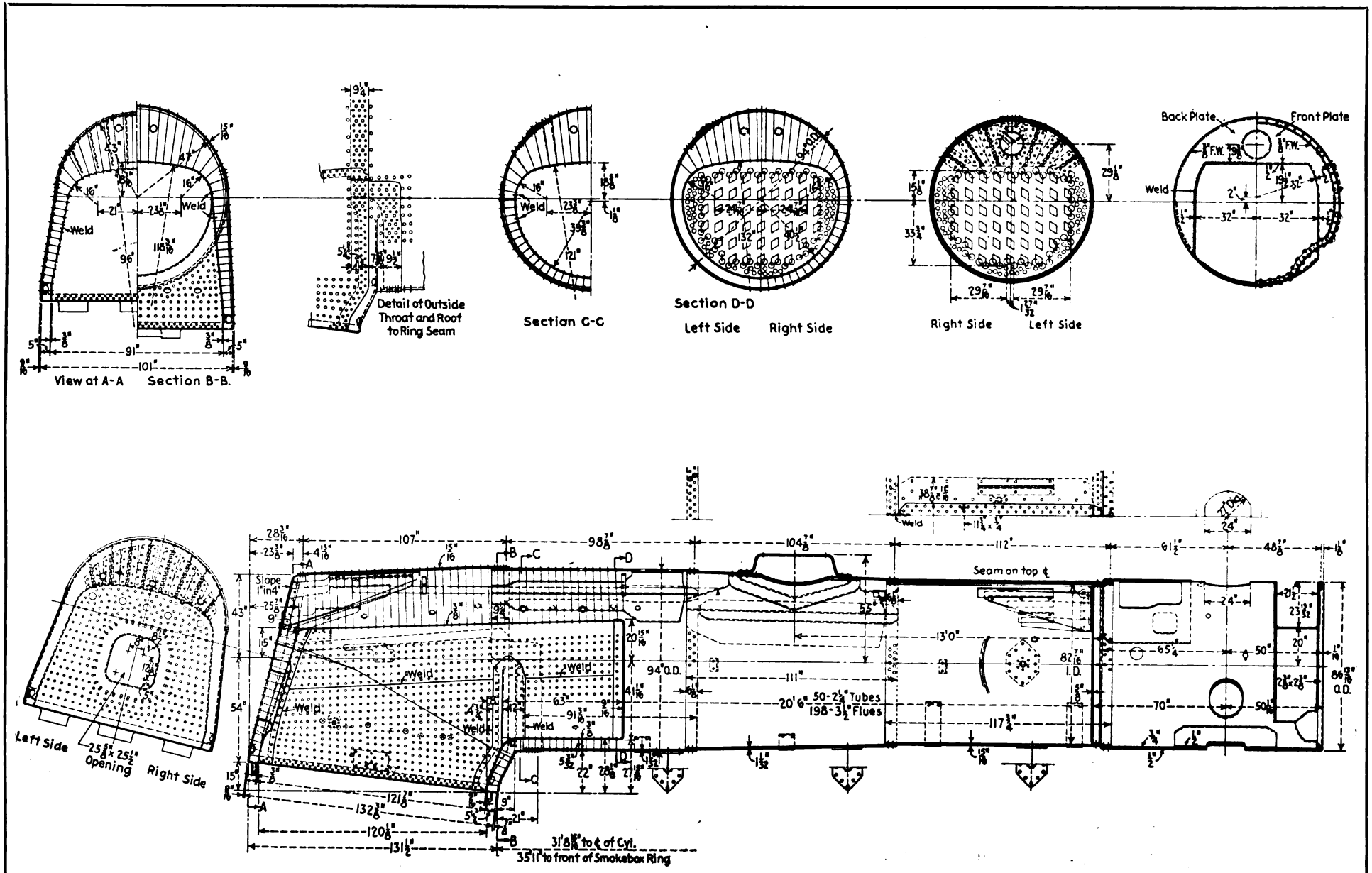
In counterbalancing the locomotives the out-of-plane effects are taken into account in all driving wheels and the main wheels are crossbalanced by angling the counterweights. The main wheels are counterbalanced to produce equal dynamic effect on both sides of the locomotive. This results in unequal compensation of the effect of the reciprocating parts on the two sides due

Comparison of Characteristics of New York Central 4-8-2 Locomotives

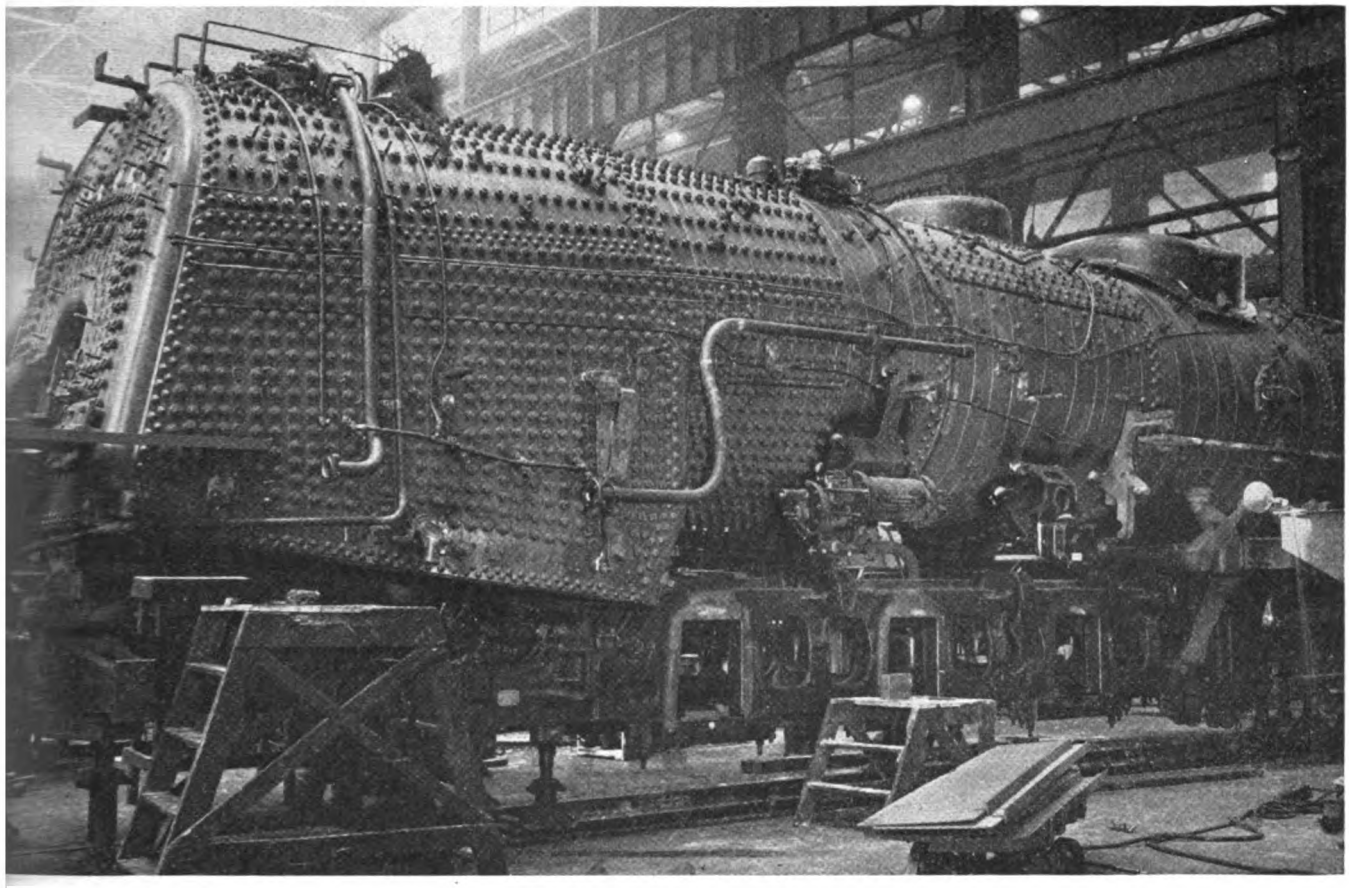
	L-2d converted 2998	L-3a (25) Alco	L-4 Lima
Builder	Alco	Alco	Lima
Road numbers	2998	3000-3024	3100-3124
Date built	March, 1930	Dec., 1940	Dec., 1942
Service	Frt. and pass.	Frt. and pass.	Frt. and pass.
Weight on drivers in working order, lb.	257,000	262,000	265,800
Total engine weight in working order, lb.	385,100	388,500	397,300
Weight of tender in working order, lb.	313,500	374,200	377,000
Cylinders, diameter and stroke, in.	25½x30	25½x30	26x30
Driving wheels, diameter, in.	69	69	72
Steam pressure, lb.	250	250	250
Fuel	Bit. coal	Bit. coal	Bit. coal
Grate area, sq. ft.	75.3	75.3	75.3
Firebox heating surface, total, sq. ft.	354	373	373
Evaporative heating surface, sq. ft.	4,556	4,657	4,676
Superheater heating surface, sq. ft.	1,931	2,080	2,103
Tractive force, engine, lb.	60,100	60,100	59,900
Tractive force with booster, lb.	73,850	.....	.....



In the erecting shop—Showing pipe connections at the front of the locomotive



Boiler elevation and cross-sections of the New York Central Class L-4a locomotive



The boiler in the erecting shop

General Dimensions, Weights and Proportions of the New York Central 4-8-2 Type Locomotives, L-4a Class

Railroad	New York Central
Builder	Lima
Type of locomotive	4-8-2
Road class	L-4a
Road numbers	3100-3124
Date built	Dec., 1942
Service	Freight and passenger
Dimensions:	
Maximum curve, deg.-min.	18—30
Height to top of stack, ft.-in.	15—1
Height to center of boiler, ft.-in.	10—1½
Width overall, in.	125
Cylinder centers, in.	91
Length overall, engine and tender, ft.-in.	109—6½
Weights in working order, lb.:	
On drivers	265,800
On front truck	73,100
On trailing truck	58,400
Total engine	397,300
Tender (loaded)	377,000
Wheel bases, ft.-in.:	
Driving	19—0
Rigid	6—4
Engine, total	43—1
Engine and tender, total	95—11½
Wheels, diameter outside tires, in.:	
Driving	72
Front truck	36
Trailing truck	44
Engine:	
Cylinders, number, diameter and stroke, in.	2 — 26 x 30
Valve gear, type	Baker
Valves, piston type, size, in.	14
Maximum travel, in.	8½
Steam lap, in.	1 9/16
Exhaust clearance, in.	2 5/16
Lead, in.	5/16
Boiler:	
Type	Conical
Steam pressure, lb. per sq. in.	250
Diameter, first ring, inside, in.	82 7/16
Diameter, largest, outside, in.	94
Firebox, length, in.	120⅛
Firebox, width, in.	90¼
Height mud ring to center line of boiler, back., in.	54
Height mud ring to center line of boiler, front, in..	69
Combustion chamber length, in.	63

Boiler (continued):	
Arch tubes, number and diameter, in.	5—3
Flues, number and diameter, in.	198—3½
Tubes, number and diameter, in.	50—2¼
Length, over tube sheets, ft.-in.	20—6
Net gas area through tubes and flues, sq. ft.	9.56
Fuel	Bit. coal
Grate area, sq. ft.	75.3
Heating surfaces, sq. ft.:	
Firebox and comb. chamber	338
Arch Tubes	35
Firebox, total	373
Tubes and flues	4,303
Evaporative, total	4,676
Superheater	2,103
Comb. evaporative and superheater	6,779
Tender:	
Type	Water-bottom
Water capacity, gals.	15,500
Fuel capacity, tons	42½
Trucks	Six-wheel
Journals, diameter and length, in.	6½ x 12
Wheel diameter, in.	41
Rated tractive force, engine, 85 per cent, lb.	59,900
Weight proportions:	
Weight on drivers ÷ weight engine, per cent	66.91
Weight on drivers ÷ tractive force	4.44
Weight of engine ÷ evap. heating surface	84.98
Weight of engine ÷ comb. heating surface	58.61
Boiler proportions:	
Firebox heating surface, per cent combined heating surface	5.50
Tube-flue heating surface, per cent comb. heat. surface	63.49
Superheater heating surface, per cent comb. heat. surface	24.64
Firebox heating surface ÷ grate area	4.49
Tube-flue heat. surface ÷ grate area	57.14
Superheater heat. surface ÷ grate area	27.93
Comb. heat. surface ÷ grate area	90.02
Gas area, tubes-flues ÷ grate area	0.13
Evaporative heat. surface ÷ grate area	62.08
Tractive force ÷ grate area	795.4
Tractive force ÷ evaporative heat. surface	12.81
Tractive force ÷ comb. heat. surface	8.84
Tractive force × diameter drivers ÷ comb. heat. surface	636.2

to the difference in the angle of the rotating balance required for the two return cranks.

The reciprocating parts on these locomotives weigh 1,535 lb. on each side. The over-balance as it affects dynamic augment amounts to 115 lb. in each front driver, 166 lb. in each main driver, 132 lb. in each intermediate wheel, and 115 lb. in each rear wheel. The ratio of unbalanced reciprocating weight to the total weight of the locomotive is $\frac{1}{366}$.

The four-wheel engine trucks are of the General Steel Castings constant-resistance type with SKF inside roller bearings in solid housings, mounted on hollow-bored axles, with 36-in. multiple-wear rolled-steel wheels. The wheel base is 86 in. These trucks are designed for a swing of 4¾ in. each side of the center. They have an initial lateral resistance of 40 per cent and a constant resistance of 33⅓ per cent.

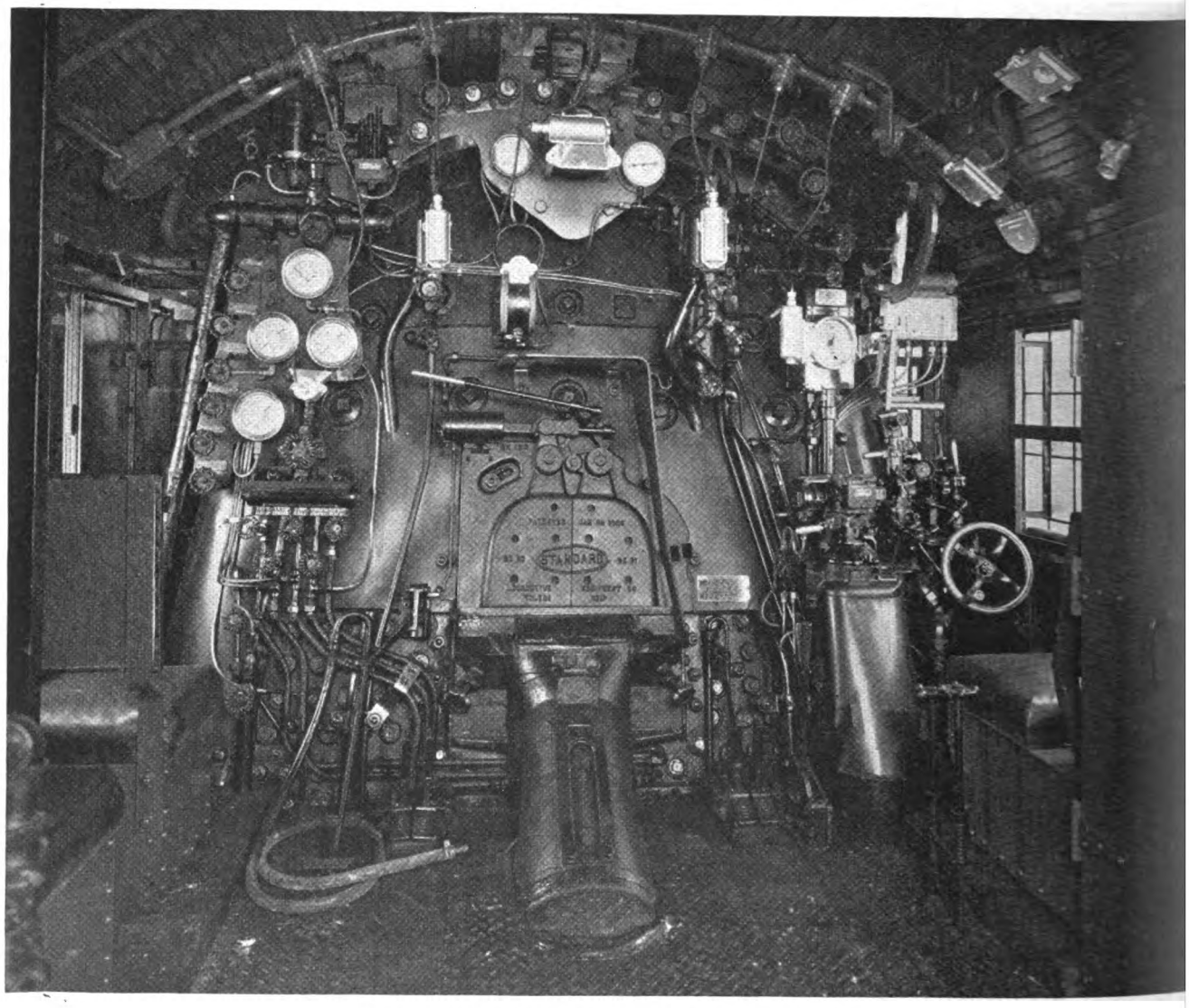
The trailing truck is of the two-wheel Delta type with 44-in. multiple wear rolled-steel wheels. They have Timken roller bearings and hollow-bored axles. There is a complete installation of Timken heat indicators on all locomotive and tender journal boxes.

Both driving axles and engine-truck axles are of normalized carbon-vanadium steel. The trailer axles are medium carbon steel, normalized and drawn. Provision is made for the application of a booster on the trailing truck, also for the future application of air brakes. Th truck has a lateral resistance of 20 per cent, both initia and constant. The pedestals both on the engine an trailer truck have spring-steel liners.

Pistons, Rods, Crossheads

The pistons, which are 26 in. in diameter, are of Tim ken chrome-nickel-molybdenum rolled steel of V-sectio and the piston rods are of the same material. The rin are of the bronze-and-iron lipped type furnished by th Koppers Company, American Hammered Piston Rin Division. Both piston and valve stems have King typ packing. The length of the piston rods permits remov of the piston heads for the renewal of packing rings with out disconnecting the piston rods from the crosshead

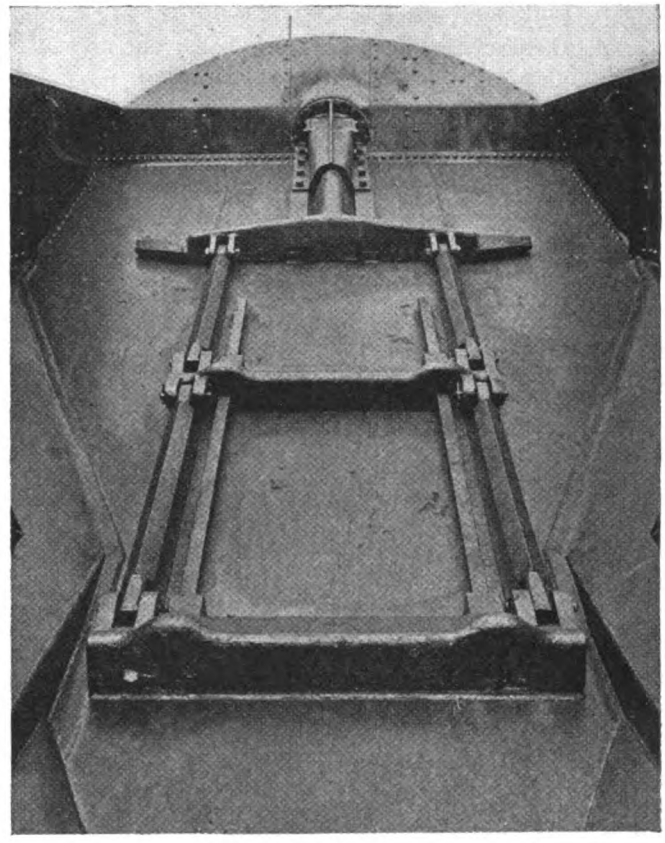
The alligator type crossheads are of Timken chrom nickel-molybdenum steel with gun-iron shoes. The wri pin is fitted with Timken roller bearings. The guides a applied to the back cylinder head with the Alco Slidgui attachment. The main and side rods are of manganes vanadium steel, normalized and tempered. The back-en main-rod bearing is bronze in a one-piece floating bush ing operating within a Hunt-Spiller gun-iron fixed bush ing pressed in the rod. The floating bushing is flangele and the main rod is spaced between the side rod and th eccentric crank by floating rings of soft steel. The sid



The cab interior of the New York Central L-4a locomotives

Partial List of Materials and Equipment on the New York Central L-4a 4-8-2 Type Locomotives

Bed castings; engine and trailer trucks; pilot; front bumper; ash pan	General Steel Castings Corp., Eddystone, Pa.
Driving wheels	(20) General Steel Castings Corp., Eddystone, Pa. (5) Scullin Steel Co., St. Louis, Mo.
Engine- and trailer-truck wheels	(10) Armco Railroad Sales Co., Middletown, Ohio (15) Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Tires	American Locomotive Co., Railway Steel Spring Div., New York
Bushings in engine- and trailer-truck frames	Ex-Cell-O Corporation, Detroit, Mich.
Roller bearings—driving-box; trailer-truck; journal-box heat indicators	The Timken Roller Bearing Co., Canton, Ohio
Roller bearings—engine-truck boxes	SKF Industries, Philadelphia, Pa.
Springs	Crucible Steel Co. of America, New York
Spring preservative	Dearborn Chemical Co., Chicago
Lateral cushioning device; Slidguide attachment	American Locomotive Company, New York
Power reverse gear	Franklin Railway Supply Co., Inc., New York
Brakes and signal equipment	New York Air Brake Co., Watertown, N. Y.
Pilot coupler	National Malleable and Steel Castings Co., Cleveland, Ohio
Ferro vanadium for the steels for driving axles, engine-truck axles, main crank pins, and main and side rods	Vanadium Corporation of America, New York
Piston-rod and valve-stem packing; air-pump packing	U. S. Metallic Packing Co., Philadelphia, Pa.
Valve gear	Pilliod Co., New York
Cylinder cocks and operating valves	The Okadee Company, Chicago
Cylinder and valve-chamber bushings; main- and side-rod bushings; piston-valve packing rings	Hunt-Spiller Manufacturing Corporation, Boston, Mass.
Crank-pin bearings	Magnus Metal Div., National Lead Co., New York
Crossheads; piston rods	The Timken Roller Bearing Co., Canton, Ohio
Piston rings	Koppers Company, American Hammered Piston Ring Div., Baltimore, Md.
Blow-off cocks	(15) The Okadee Company, Chicago (10) Wilson Engineering Corporation, Chicago
Jacket steel	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Fire door	Standard Locomotive Equipment Company, Toledo, Ohio
Fire brick	General Refractories Company, Philadelphia, Pa.
Grates	Waugh Equipment Co., New York
Boiler tubes	(10) Globe Steel Tubes Co., Milwaukee, Wis. (15) Republic Steel Corp., Steel and Tubes Div., Massillon, Ohio
Staybolt iron	Joseph T. Ryerson & Son, Inc., Chicago
Flexible bolts; expansion stays	Flannery Bolt Co., Bridgeville, Pa.
Arch-tube plugs; washout plugs; cylinder port plugs	Huron Mfg. Co., Detroit, Mich.
Boiler braces	American Locomotive Co., New York
Exhaust-pipe gasket	Johns-Manville Sales Corp., New York
Continuous blow-down system	National Aluminate Corp., Chicago
Superheater; Tangential steam dryer	The Superheater Company, New York
Stoker	Standard Stoker Co., Inc., New York
Dri-Steam separator for turret dry-pipe	Dri-Steam Products, Inc., New York
Superheater pipes	(10) Globe Steel Tubes Co., Milwaukee, Wis. (15) Republic Steel Corp., Massillon, Ohio
Throttle	American Throttle Co., New York
Feedwater heater	Worthington Pump and Machinery Corp., Harrison, N. J.
Stoker and feedwater heater gages	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Injector; boiler checks	Nathan Manufacturing Co., New York
Valves and valve trimmings	Ohio Injector Co., Wadsworth, Ohio
Line checks	Crane Co., Chicago
Boiler lagging	Johns-Manville Sales Corp., New York
Smokebox blower fittings	Barco Manufacturing Co., Chicago
Smokebox netting	The W. S. Tyler Co., Cleveland, Ohio
Smokebox front gasket	The Garlock Packing Company, Palmyra, N. Y.
Pipe and pipe nipples	A. M. Byers Co., Pittsburgh, Pa.
Pipe fittings	Corley Co., Jersey City, N. J.
Pipe lagging	Union Asbestos & Rubber Co., Chicago
Safety valves; steam gages; sprinkler	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Cab apron	Inland Steel Co., Chicago
Cab curtains	The Lehon Co., Chicago
Cab sash	O. M. Edwards, Inc., Syracuse, N. Y.
Glass (laminated)	Pittsburgh Plate Glass Co., Pittsburgh, Pa.



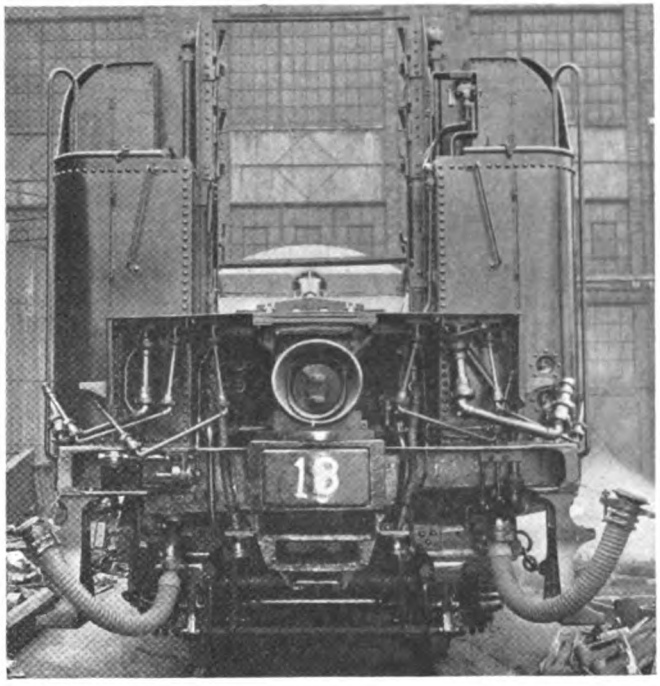
Inside the tender coal space

Cab insulation	The Pantasote Company, Inc., New York
Air gages	Ashton Valve Co., Boston, Mass.
Water column	Nathan Manufacturing Co., New York
Water gages	The Okadee Company, Chicago
Steam-heat regulator and gage	Vapor Car Heating Co., Inc., Chicago
Sanders	Graham-White Sander Corp., Roanoke, Va.
Tubing for air lines to sanders, bell ringer and whistle; for feed lines from force-feed lubricators	Bundy Tubing Co., Detroit, Mich.
Headlight	The Pyle-National Company, Chicago
Train control	General Railway Signal Co., Rochester, N. Y.
Whistle	Nathan Manufacturing Co., New York
Low-water alarm	Barco Manufacturing Co., Chicago
Valve Pilot	Valve Pilot Corporation, New York
Lubricators	Detroit Lubricator Co., Detroit, Mich. Nathan Manufacturing Co., New York
Grease fittings	Alemite Div., Stewart-Warner Corp., Chicago
Bell ringers	Railway Service and Supply Corp., Indianapolis, Ind.
Paint	The Glidden Company, Cleveland, Ohio
Piping between engine and tender	Barco Manufacturing Co., Chicago
Drawbar between engine and tender	Franklin Railway Supply Co., Inc., New York
Tender:	
Frame; trucks	General Steel Castings Corp., Eddystone, Pa.
Springs	Crucible Steel Co. of America, New York
Axles	Bethlehem Steel Co., Bethlehem, Pa.
Bearings	SKF Industries, Philadelphia, Pa.
Journal-box heat indicators	The Timken Roller Bearing Co., Canton, Ohio
Clasp brake rigging	American Steel Foundries, Chicago
Wheels	(10) Armco Railroad Sales Co., Middletown, Ohio (15) Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Draft gear	Waugh Equipment Company, New York
Draft-gear attachment; swivel butt coupler	The Symington-Gould Corp., New York
Swing-hanger bushings	Ex-Cell-O Corporation, Detroit, Mich.
Coal pusher	The Standard Stoker Co., Inc., New York
Washout plugs	Huron Mfg. Co., Detroit, Mich.
Piping	A. M. Byers Co., Pittsburgh, Pa.
Manhole and back-up lamps	The Pyle-National Company, Chicago
Tank-water level indicator	Manning, Maxwell & Moore, Inc., Locomotive Equipment Division, Bridgeport, Conn.
Steam-heat connection and coupling head	Vapor Car Heating Co., Inc., Chicago

rod bearings on the main and intermediate crank pins are also bronze floating bushings. The front and back crankpin bearings are fixed bronze bushings.

The main crank pin is manganese-vanadium steel, normalized. The others are medium carbon steel, normalized and drawn. All except the front crank pins are hollow bored.

Steam is admitted to the superheater through a Tangential steam dryer, and the American multiple throttle



Steam, air and water connections at the front end of the tender

is included in the superheater header. The lightweight piston valves are 14 in. in diameter driven by a Baker gear with McGill Multirol needle bearings. The packing rings are Hunt-Spiller gun iron. The power reverse gear is the Franklin Precision type.

Lubrication and Cab Fittings

There are two force-feed lubricators on each locomotive. That on the right side feeds valve oil to the steam-chest cylinders, the air compressors, the stoker engine, and the feedwater hot pump. The lubricator on the left side supplies engine oil to the valve stem crosshead, the main guides, the driving boxes, the engine-truck and trailer-truck pedestal faces, to the trailer-truck center pin, and to the radial buffer between the engine and tender. In addition to the extensive oil lubrication, Alemite soft grease fittings are applied on the valve motion, power reverse gear, and throttle rigging.

To keep within clearance limits on curves the cabs are slightly tapered, front to rear. They are of riveted-steel construction with wood lining and Agasote insulation. The windows are Pittsburgh laminated glass in Edwards steel sash. The cab curtains are of Mulehide. The boilers are protected with Barco low-water alarms. The blower is the only auxiliary supplied with superheated steam which is piped directly from the superheater header. Saturated steam for the remainder of the auxiliaries is taken from a turret located on the roof sheet just ahead of the cab. This is supplied through two drypipes which are fitted with Dri-Steam separators in the dome.

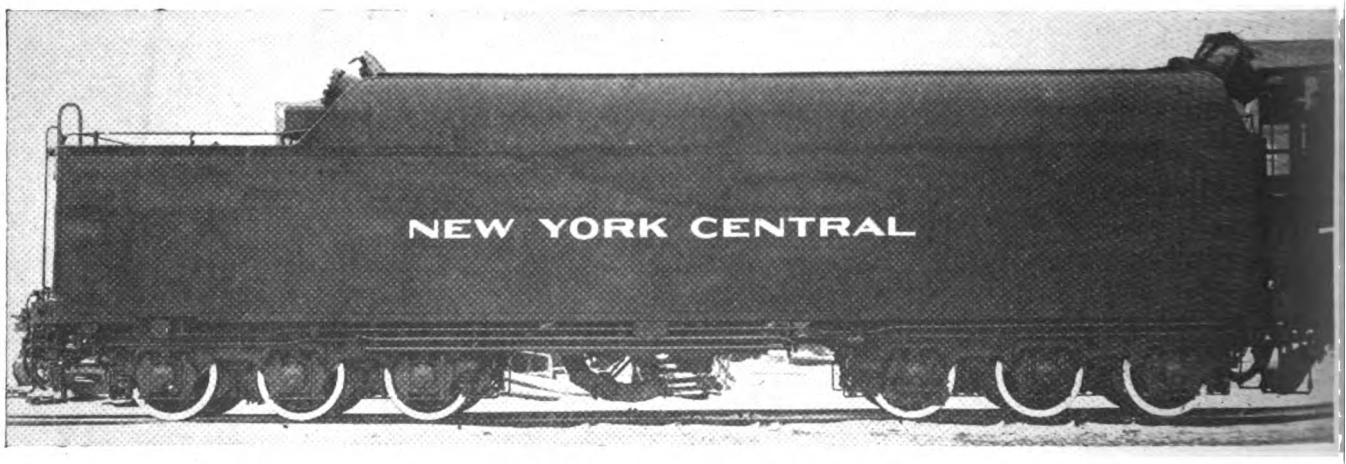
The engine-tender drawbar is the Unit Safety type and slack is controlled by the Franklin E-2 type buffers. Barco flexible joints are air and steam connections.

The Tenders

The tenders are of rectangular water-bottom type built up on General Steel Castings water-bottom tender frames. The tank is of riveted construction with a single riveted joint between the side sheets and frame, the edges of which are welded inside and out. A Standard type DA coal pusher is installed in the tender. There is also a water scoop.

These tenders are of the same large capacity as those first used behind the L-3 class locomotives. Their coal capacity of 42½ tons is a large factor in the versatility of these locomotives in universal main-line service.

The six-wheel tender trucks have General Steel Castings frames with swing motion bolsters and are equalized. The multiple-wear rolled-steel wheels are 41 in. in diameter, mounted on axles of 6½ in. by 12 in. nominal journal sizes, fitted with SKF roller bearings. The brake rigging is the A. S. F. clasp type. There are two brake cylinders, mounted on the tender frame. The tenders are now fitted with Waugh-Gould draft gear No. 403 with Farlow 2-in. key type attachments and Type E swivel-butt couplers. The bed castings, however, are designed for the future application of Waugh rubber draft gears.



This tender design was first used on the L-3a locomotives built in 1940—It carries 42½ tons of coal

Roundtable:

Stop Abuse of Forged Parts

Education A Vital Factor

The advent of roller bearing equipment and alloy steels into the materials which constitute the modern locomotive has compelled the repair shops to institute a program of education among the supervision and shop forces. The expert handling of these new materials to insure the absence of nicking and burring while being repaired is and has been a matter of education, which must be followed religiously.

To cite an example, the radii on the edges of rods and motion work were being chipped by the use of a special chisel ground in the center to the correct radius. There were numerous failures of these parts, which could not be attributed to any particular reason. On careful inspection it was found that in chipping these edges there was being set up a series of minute fractures, which in time progressed to ultimate failure. By changing the method and grinding instead of chipping these failures were eliminated.

The use of soft vise jaws, soft hammers and careful filing and handling is also a contributing factor to the answer of fewer nicks and the avoidance of failures.

The publishing of all failures caused by abuses of this kind is an important factor in the educational program, which is the direct solution of this problem.—*W. E. Buck, Superintendent of Shops, N.Y.C.*

Better Inspection Needed

Railroad equipment maintenance repair work differs from the usual run of industrial work in that it is primarily concerned with repairs and reconditioning of material and parts that have been in service. The economic use of materials does not permit bringing the parts back to exact standards; consequently every labor operation must concern the removal of the minimum amount of materials in order to extend the life as much as possible. This very feature makes every workman to some extent an inspector of semi-supervisor. It further necessitates a relatively longer period of training and instructions for the new employees, all of which throws a greater responsibility on those classified as inspectors and supervisors. The inspectors will have to develop a surer knowledge and exercise a more positive judgment in the reporting of necessary work. This may require some further training to develop the inspector's judgment as to the things that are safe for service and those which are not. Some of these decisions, normally, were reserved entirely for the supervision, but inspectors should be trained to be of more positive assistance.

Machine operators engaged in the forming of, or the removal of, metal must be more careful than ever in the finishing operations so as to eliminate tool marks, sharp fillets, seams, laps and such minute defects as later develop into progressive fractures. Floor or bench men must be prohibited from trimming or cutting sheet metal liners on running gear by chisels; using the running gear as anvils for the straightening or the cutting of wires, cotters and the like. Similarly, the use of these parts for making ground connections by the autogenous welders must be discouraged.—*H. Courtney, Shop Superintendent, Pittsburgh & Lake Erie.*

Pertinent Suggestions

Repairs to our modern locomotives should be given more careful attention than is now being done. More care should be exercised in the machining of crank pins, driving axles, links, radius rods, eccentric cranks, eccentric rods, union links, combination levers, brake beams, brake beam hangers and the parts most subject to failure in the unusually severe road service that is new being encountered.

Fillets with long radii should be used and all tool marks should be finished or polished out of all machined surfaces. Too many machine operators use a high polish, yet do not remove all of the tool marks. Tool marks, even comparatively insignificant ones, are often the starting point of fractures which cause failures, and failures result in train delays.

In forging all motion work parts, axles, crank pins, and similar parts, a common failure is not to use enough time in the first slow heating of the billets. They should be properly and slowly heated before forging, but should not be forged at too low a temperature. After forging, the forging stresses should be removed before machining the parts. After the parts are machined the machining stresses should be removed before giving them the final heat treatment. A serious oversight with locomotive parts is that not enough time and care is exercised in the machining and heat treatment of these parts, and frequently not enough care is taken in the selection of the proper kind of material to be used.

Many railroad locomotive shops are not equipped with facilities for testing out the different types of steel and, therefore, a steel not suitable for the purpose is often used. Naturally it is of primary importance to know before a forging is started that the billet is of the proper composition for the service required. The testing laboratory, therefore, plays an important part in selection of locomotive repair material.—*E. J. Hausbach, Shop Superintendent, Wabash, Decatur, Ill.*

Inspection and Education

The protection necessary to insure against failure of highly stressed machined parts can be enhanced by two methods, namely, rigid inspection and education.

Shop inspection insures that the designs of the parts are faithfully carried out in their manufacture, and that a finish suitable to the importance of the part is applied. Inspection at engine terminals should reveal the presence of the various causes of failure nearly as soon as they occur. By causes of failure, I refer to nicks, bruises, arc or torch burns, etc. The quick removal of such defects by grinding the injured parts away, and providing in their place a smooth finished depression with suitable radii, will generally prevent the occurrence of a progressive fracture.

To secure an inspection which will locate these initial defects, it is necessary that the parts to be inspected be thoroughly cleaned by one of the several methods now in use on up-to-date railroads. A dirty, grease-coated part cannot be adequately inspected. A clean rod or part can be given close inspection in the time usually allotted for this work.

Education enters the picture when portions containing the fracture are removed from large parts, or entire small parts which have failed, or which have been discovered to be cracked by magnaflux inspection, are circulated among the various foremen responsible for their maintenance. The average employee is often skeptical of the claims that small nick or arc burn will eventually cause a complete fracture, but can usually be convinced that such claims are true when confronted with the actual parts, showing fracture lines starting at the point of injury and progressing from there into the part, until finally complete fracture occurs.

A few minutes by a gang foreman, in explaining the seriousness of small defects to each member of his gang, will serve to prevent defects caused through carelessness by men who do not realize the results of these apparently minor nicks. The employee should also be advised that immediate removal of the defect by the above-mentioned methods will minimize the possibility of future failure.

A certain responsibility rests with the individual foreman to see that his men are supplied with the necessary wood blocks, soft hammers, etc., used by his gang in handling the parts concerned. Lack of proper equipment often results in careless handling practices, which otherwise would not occur.

Close attention to these suggestions will, I believe, contribute to the greater service now required of these highly stressed parts.—*T. J. Lyon, Superintendent Locomotive Shops, N.Y.C., Beech Grove, Ind.*

EDITORIALS

Tell Us How You Prevent Accidents

War conditions and manpower shortages have focused attention sharply upon handicaps which prevent us from achieving maximum production in industry and transportation. Preventable accidents stand out in distinct relief as one of the chief causes of loss of manpower. While the railroads were leaders in starting the safety first movement, their safety records in the mechanical department are not uniform or on the whole satisfactory. It is true that some mechanical departments have made remarkable records in accident prevention, but unfortunately others lag far behind. Please tell us out of your own experience how you think a better job can be done. Specific facts about how troublesome problems have been overcome and the records improved, will be particularly appreciated. Your letter must reach our New York Office as promptly as possible, and not later than August 15.

Facts vs. Slogans

Statements issuing from Washington indicate that there is dissatisfaction with the war production program—that May and June outputs of weapons important in the conduct of global warfare have not been up to the quotas. Even more than hints have been heard that the public is complacent—that it thinks the war is almost won and so is taking it easy. Specifically, absenteeism is pointed out as a cause of the slump—by inference the principal cause. So much concern is felt that a new slogan has been proposed to pep up the workers on Navy contracts.

This is not the first time the American people have been accused by officialdom in Washington of being complacent. If there is any truth in the charge, at least one cause is fairly obvious: that is, the extent to which the public is kidded with slogans and deprived of facts. A few facts might be helpful in the present situation.

Is absenteeism an adequate explanation of the failure to meet the quotas? There are signs that the inroads of the military forces on available manpower are actually beginning to embarrass essential industry. The want-ad pages of city newspapers throughout the country suggest that a desperate struggle is going on for many classes of skilled workers and supervisors. In view of the persistence of these ads is it inferring too much to assume that the response is not adequate to the needs?

This is the first total war in which the United States has been engaged. The utmost effort of the entire nation must be put forth if it is to be completed successfully and without unnecessary waste of life and other national resources. It is the first time we have faced the necessity of carefully balancing our use of every resource, both material and human. There is grave suspicion in the minds of many citizens that our national management of manpower is not based on an understanding of this situation—that the programs of the military establishment have been accepted without adequate consideration of their relationship to all other phases of the national war effort.

Evidences of strain in that respect are beginning to appear in the railroad industry. The report of the Railroad Retirement Board indicates that as of June 1 there were unfilled needs for over 73,000 persons. The largest number of unfilled vacancies—44,350—were in the maintenance of way and structures department, in which, no doubt, seasonal influences are involved. The next group, however, is maintenance of equipment and stores of over 19,000, which is not seasonal. While not yet alarming, the situation is getting critical.

It is important that the American people know the facts with respect to this situation because on their understanding of the facts will depend the character of their contribution to the nation's all-out warfare. Even if it is necessary that we build up our armed forces faster than they can be supported at present rates of output per man-hour, the additional desperate effort needed will not be forthcoming until public suspicion is replaced by public understanding.

What Is An Adequate Depreciation Rate?

Many shop engineers in both manufacturing and railway fields have accepted the idea that the only certain way in which shop equipment such as that in car and locomotive shops can be kept up-to-date is to set up a reserve fund—such as a reserve for depreciation—out of which new equipment is purchased periodically. No doubt the proponents of this idea will be sympathetic to the bill recently introduced (S. 931) by Senator Stewart of Tennessee, which would require the railroads to maintain in liquid form a fund for the replacement of depreciated property.

For years there has been a mild debate going on between those who accepted the retirement method of accounting and those who believe that the only logical method of charging off wear, tear and obsolescence is that of straight-line depreciation. For those who favor this latter method, there will be support in the recognition by the I. C. C. of the adaptability of this latter accounting method to present-day needs. An order, effective January 1, 1943, makes mandatory the application of composite annual rates as a basis of monthly charges to the appropriate depreciation accounts.

For sake of argument, it might be said that retirement accounting sets up a rather inflexible system that has operated in many instances as a handicap to the acquisition of new machine tools and shop equipment required to replace worn-out and obsolete units. Regardless of any handicaps of the retirement, or any other accounting system, the principal handicap to the acquisition of new shop tools and equipment has been the necessity on the part of mechanical officers and supervisors of justifying the installation of new and sometimes very expensive machinery where the rate of output or the potential hours of usage were too low to show an adequate return on the investment. Inasmuch as most roads require approximately 17 per cent return, there has been relatively little new shop equipment purchased in the railroad field for 10 to 15 years.

In spite of the Commission's order affecting straight-line depreciation, there still remains the problems of establishing equitable depreciation rates for machine tools and shop equipment. Under the order, rates set up by the Bureau of Valuation are to be used until such time as the carriers can assemble data and file tentative rates with the Commission.

The real problem in the establishment of depreciation rates with respect to railroad shop machine tools is the fact that the real life of such a unit of equipment must be measured in machine hours and not in months or years. In "normal" times, such as those immediately preceding the outbreak of the war, the actual total annual machine hours of service of the average machine in a railroad shop, on the basis of single-shift eight-hour days, would be so low that a relatively low depreciation rate could be justified. On the basis of such a low rate the ultimate life of the tool must of necessity spread out over a number of years. This, of course, took no cognizance of obsolescence in shop equipment with the result that, today, most of our shops are very much out of date as regards shop equipment.

On the other hand, when shops are operated at the rate they are being used today, with many tools being used on practically 24-hour shifts, it is obvious that a depreciation rate based upon a normal machine-hour usage would be entirely inadequate.

These points are mentioned to emphasize the necessity of making a thorough study of locomotive machining operations, not only because of the value of such a study in the establishment of proper depreciation rates but to be able to set up that which has always been badly needed—an intelligent program of shop equipment replacement.

We have always been suspicious that had the railroads had such a program, any controversy as to the relative merits of retirement and depreciation accounting would have had very little significance. After all, the ultimate objective is to keep our shop facilities in such physical condition as to be able to repair equipment at minimum shop cost.

Good Ideas As Helpful As Additional Manpower

This thought is not new but it is possibly being overlooked in some American railroad shops. Employee-suggestion arrangements and labor-management committees have been employed on a number of roads for many years and have contributed much to the development of better working conditions or improved methods of work performance. We call attention to these plans again because, with the ever-increasing difficulty in obtaining a sufficient number of skilled or semi-skilled employees, other factors must be more carefully considered in the light of their possibilities for more effectively utilizing the forces now available.

Nothing at the present time can contribute more to the number of man hours available for productive effort than the study of job methods. Other industries are finding this fact to be so true that financial rewards of substantial size are often made for relatively minor improvements in tool design, machine set-up, jig arrangements or work scheduling. Where the monetary incentive is not offered suggestions still pour from the employees where management makes it clear that the suggestions will receive thoughtful consideration. It is true of the American workman generally that adoption of a suggestion which he has made is a real personal satisfaction to him apart from any direct economic benefit.

In any tool room or machine shop there is always at least one, and usually more than one, employee who is known among his fellow workmen as a fellow who is

always tinkering, thinking and experimenting. Not all of his ideas work, or are profitably useful if they do work, but some of them prove adaptable to shop needs and are eventually employed. The purpose of the "shop-kinks" section of this and other technical publications is to pass on such ideas from practical men to others who might be able to use or to adapt them. Only a small percentage of them ever reach an editor's attention. Within each shop there may be some which never reach a foreman's attention for any one of a number of reasons. Perhaps the men are not encouraged to develop their ideas; perhaps the foreman is "too busy"; perhaps he wants to initiate all the ideas himself; perhaps sufficient credit is never given for ideas when adopted; perhaps no one has ever thought of encouraging them.

Whatever the reason, here is a potential source of productiveness in the shops of all railroads today. On some it is being made use of to a great extent, on most it could be more widely explored. The initiation of job instructor training and of job method training on most roads will help somewhat; the consideration of such training as a virtual source of manpower capacity will help to an even greater extent.

Preventive Maintenance

In the mind of the electrical man, the term "preventive maintenance" is apt to conjure up a picture of a megger being used to measure insulation resistance. In recent years, much attention has been drawn to the importance of keeping a record of insulation values on electrical equipment, since they indicate the degree of progressive deterioration and permit the making of minor repairs which prevent costly failures.

War requirements have greatly increased the need for preventive maintenance and it is being broadly applied. The proper procedure for lubricating a motor or a generator is common knowledge. It consists of using not too little and not too much of the right kind of lubricant. Close attention to these needs avoids both bearing and insulation failures and amounts to preventive maintenance.

A traction-motor commutator is one of the most vital parts of an electric or Diesel-electric locomotive. Its condition will show the skilled observer not only the condition of the motor but also faulty functioning of other equipment or improper operations of the locomotive. Similarly, frequent inspection of the end of the armature away from the commutator will avoid trouble. This is the hot end, since ventilating air is brought in over the commutator, and it is subject to the effects of loose bands which will allow coils to work in their slots. Attention given to this will prevent insulation failures.

Dirt is probably the worst enemy of electrical equipment. Thus cleanliness is a first rule in preventive maintenance. This applies with particular force to air-conditioning apparatus. Here excessive accumulations of dirt mean insufficient air circulation, reduced capacity, excessive head pressures and ultimately they lead to complete failure.

So simple a thing as a vee belt, representing important strategic material, is subject to preventive maintenance. If they are given proper tension, always kept in alignment on parallel shafts, never applied by forcing them over the pulleys and always used as matched sets, their life can be greatly extended. Assurance of properly matched sets can be had by using a shop-made device which permits measuring the length of a belt under operating tension.

Programmed maintenance of lighting systems is also an effective preventive measure. It involves regular inspection and cleaning of fixtures and the renewing of lamps on time schedules rather than waiting for one to burn out before sending a man out to replace it. Attention to proper socket voltage is also important, since lamps are no longer available in a great variety of voltage ratings.

The life of wire and cable is being extended by increasing circuit voltages and thereby reducing current values and also by the use of capacitors for improving the power factor. The net result is better regulation at lower overall cost.

The trend toward conservation is also being indicated by the development of new devices. An example of one of these is a hot journal alarm system now applied to Diesel-electric locomotives which warns the operator of a dangerous rise of temperature in any of the journal bearings on the locomotive.

One point to be noted in these trends is that a large part of the preventive maintenance work can be performed by unskilled labor, thus relieving the shortage of skilled workmen. Another is that with the cessation of the war, the railroads must continue to practice rigid economy and many of the good habits forced upon them by present circumstances can result in lasting benefit.

New Books

WORKING STRESSES. *By Joseph Marin. Published by the Rutgers University Press, New Brunswick, N. J. 42 pages, 5½ in. by 8 in., illustrated. Price, $1.*

The selection of the current working stress value for the design of a structure or a machine is one of the major considerations in obtaining a safe and economic construction. The major factors involved in this selection are those such as the reliability of the materials; exactness with which the loads are known; accuracy of the theory for computing the stress and certain factors of time such as corrosion, deterioration and creep. In this volume three loading conditions are analyzed, namely, static loads, fluctuating loads, and creep and discussed in detail, with appropriate diagrams to illustrate the discussion.

THE READER'S PAGE

110 Volts For Passenger Cars

To the Editor:

In the July issue of *Railway Mechanical Engineer,* W. S. H. Hamilton, equipment electrical engineer, New York Central System, takes exception to editorial comments on the merits of 110-volt systems which appeared in the May number. He makes such a strong case for 64 volts that some added support for 110-volt systems seems to be in order.

The statement made in the editorial that cars equipped with a 110-volt system do not require charging at the Jacksonville Terminal is correct. The 110-volt system is to some extent responsible for the elimination of yard charging in that batteries composed of a large number of small cells have much better ventilation and this improves their capacity to take a charge or a discharge.

With reference to the use of the higher voltage lamps, Mr. Hamilton calls attention to the fact that there are no 110 but only 115-volt lamps available. The 110 is of course a nominal rating. As a matter of fact we actually use lamps rated at 120 volts. We admit the lumen output of a 115-volt lamp is only 79 per cent of the lumen output of a 30-volt lamp, based on the 40-watt size. What happens with the 60-volt lamp that Mr. Hamilton is using?

When we first started out with the 110-volt system, we did expect some lamp theft. Very much to our surprise, this has not occurred, and even though we were losing them through theft and 50 per cent of them were stolen, the lamp cost still would just match the 30 and 60-volt lamp cost. We also thought when we first went into the 110-volt system that lamp life would be shorter than that of the 30-volt lamp. This has not worked out in practice. The frailer filament in the 115-volt lamp has three anchorages, while the 30-volt lamp has only one.

Concerning the lighting of cars from 110 volts or 220-volt, 3-phase standby power, I do not think the railroads will equip all their cars with transformers, as the need for lighting from standby power is infrequent. Actually 110-volt power is available practically everywhere there is 3-phase standby power or alternating current yard lighting. The 220-volt, 3-phase power or single-phase lighting current can be used for lighting 110-volt cars by having a balancing transformer across the 220-volts.

Mr. Hamilton questions the desirability of using a large number of battery cells with a small number of plates as compared with fewer cells having a larger number of plates in parallel. I think if he will consult some storage battery engineers, they will tell him that where a given amount of power is to be secured from batteries it is better to have the greatest number of cells that space will permit rather than have only a few very large cells.

We are in agreement with the statement that the reason for the adoption of a voltage higher than 32 is that the lower voltage cables and motor commutators are too large when used in connection with electro-mechanical air-conditioning equipment. That is one of the reasons we adopted the 110-volt system and did not stop at 64 volts. The statement that the reduction in size of wiring in going from 64 to 110 volts is not anywhere near as important an item as that secured in going from 32 to 64 volts is not understood. In going from 32 to 64 volts the wire size can be reduced 50 per cent. In going from 32 to 110 volts the wire size can be reduced approximately 75 per cent.

The most outstanding advantage of the 110-volt system is that it permitted us to rebuild 4-kw., 40-volt, Gould and U. S. L. generators into 150-volt, 20-kw. generators, and convert 2-kw., 40-volt, U. S. L. generators into 10-hp., 125-volt compressor motors. The rebuilding of the old 40-volt equipments effected about $1,000 saving per car in the application of air-conditioning equipment.

I think all concerned can see that Mr. Hamilton took a step in the right direction when he changed from 32 to 64 volts. We think that he would have been better off had he taken two steps in the same direction.

C. P. Taylor,
Electrical engineer,
Norfolk & Western Railway Company,
Roanoke, Va.

Possibilities of Plastics

To the Editor:

The General Electric is a large producer of plastics and their trade name is "Textolite". We used a certain amount of plastics when we built "The Southerner" and "The Tennessean" streamlined trains. All the window sills were covered with Westinghouse plastic, known as "Micarta". We also used other plastics for table tops, mouldings and miscellaneous furnishings and decorations.

I checked this matter with one of the research engineers of the General Electric and as far as I can discover at this time, aside from decorative effects and miscellaneous fittings that would have passenger appeal in passenger-train cars, we have not reached the point where the industries are in a position to furnish plastics in volume enough to take the place of steel sheets, shapes, plates and bars in freight car construction, or in steam or Diesel locomotive construction, especially with the heavy poundage of plastics flowing into the materiel of war.

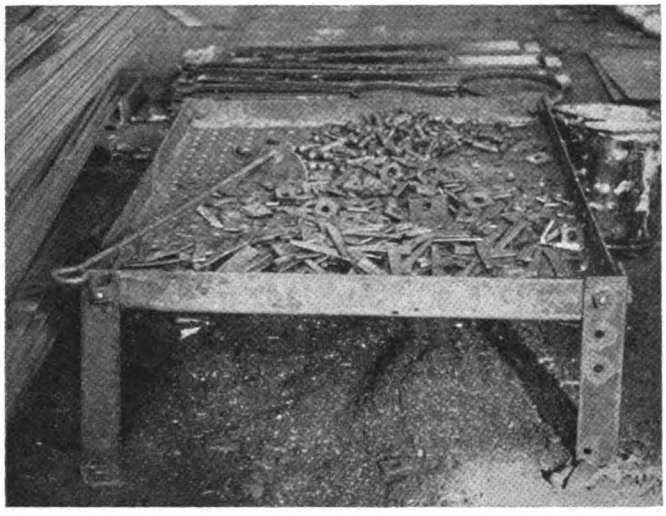
What the future will bring in the way of lightweight construction in passenger and freight service in the elimination of hauling of such large dead loads as we are now hauling to move a ton of revenue freight, I am not in a position to predict, but I think it would be safe to say that the trend will be in that direction and there will certainly be great competition between the various metals, as well as between the plastics and the metals, when peace comes once again.

J. M. Plaskitt,
Mechanical Engineer,
Southern Railway System

With the Car Foremen and Inspectors

Cleaning Tray For Fit-Up Bolts

Fit-up bolts, nuts, washers and key bolts are speedily recovered for use on the cleaning tray illustrated. The tray is in use at the Dunmore, Pa., shops of the Erie and consists of a perforated steel plate with flanged sides mounted on legs about 14 in. in height. Shop



Cleaning tray for fit-up bolts

sweepers collect all such materials in their regular cleaning and pour the accumulation of dirt, scale and reusable materials onto the cleaning tray. This is worked with a hoe until all dirt and scale has dropped through the holes in the plate. The cleaned parts are then sorted into containers for re-use. This method has been found to be much faster and more convenient than the former practice of having laborers pick up these small parts individually at the riveting locations.

Plywood Easily Handled In Railway Car Construction*

By E. L. Krietemier

The use of plywood in building and repairing refrigerator cars indicates some distinct advantages in handling and storing, as compared with handling and storing tongue-and-groove lumber.

We are constantly confronted with the proper storage of such items as siding, lining, flooring, etc., which must be given full protection from the elements. Since available storage space is limited it is necessary to utilize all available space to the best advantage. Plywood has reduced the amount of floor space required.

The difference between the size of tongue-and-groove lumber and the actual covered space on a car results in a loss of storage space. The standard 3¼-in. face tongue-and-groove lumber has the additional width of the tongue, or about ¼ in., making the overall measurement of the board 3½ in., so the actual covered space on the car of 3¼ in. results in a loss of approximately 7 per cent in storage space. The use of plywood avoids this.

To illustrate let me cite an actual case of storage space on roof sheathing used on refrigerator cars: A sufficient amount of 1-ft. by 4-ft. by 18-ft. tongue-and-groove roof sheathing for 50 refrigerator cars requires a space 12 ft. wide and 18 ft. long, or 216 sq. ft., piled 8 ft. high. A sufficient amount of plywood for the same purpose requires a space 4 ft. wide and 12 ft., 6 in. long, or 50 sq. ft., piled 7 ft. high, resulting in a saving of 166 sq. ft. of floor space.

Considering that a like saving is realized on siding, floor, lining, ceiling, insulation, and in our particular cars, drain floors, it is safe to assume that the saving in floor space is at least 75 per cent.

Marked Difference in Handling Cost

Tongue and groove lumber is available in 3¼ and 5¼-in. face and in lengths of 8, 10, 12 ft. and upwards, in multiples of 2 ft. This makes it necessary to order in lengths with a minimum offal, and then cover a given space with as many 3¼ or 5¼-in. boards as are necessary. In comparison to the many pieces of tongue-and-groove lumber, plywood is ordered in large sheets, in most instances 4 ft. by 8 ft., with smaller pieces to fill out. This creates a considerable saving in handling, not only at the time of receipt of the material, but also in delivering to the car on which it is to be used. In addition, the handling to the mill to cut to size and square is entirely eliminated, as the plywood is ordered to the exact sizes required.

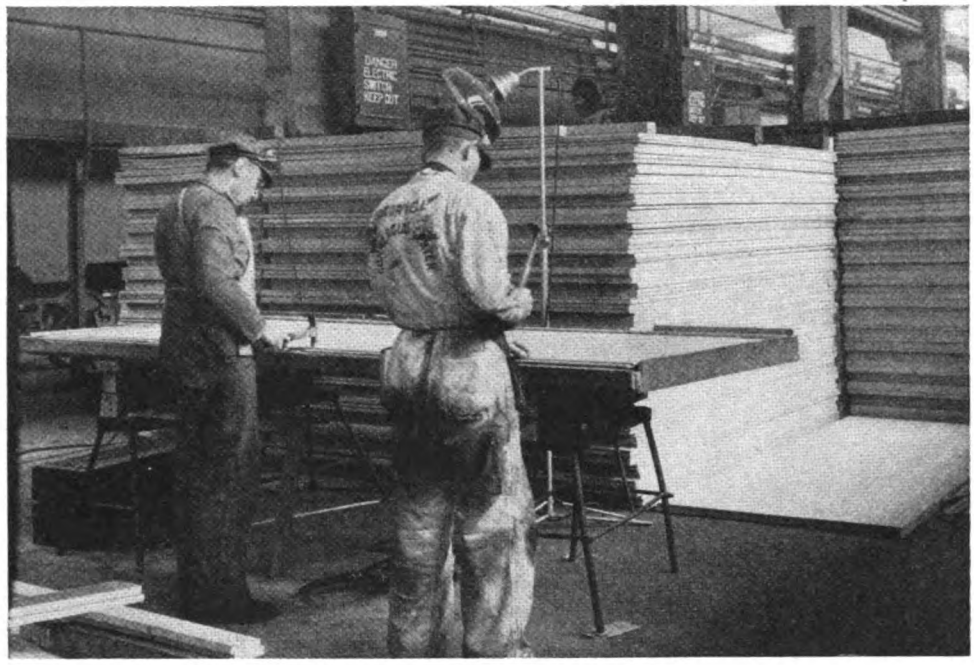
A more exact picture of the difference in the handling of tongue-and-groove lumber and plywood is shown in our operations on drain floors. In the application of one drain floor we use 73 pieces of 1 by 4 by 18-ft. lining, which is cut into 292 pieces, 4 ft. 1 in. long. After this material is unloaded from the car in which it is received, it is placed on the lumber pile. As required, these 73 pieces are removed from the lumber pile, loaded on a lumber truck and delivered to the mill. They are then removed from the lumber truck, cut into 292 pieces of 4 ft. by 1 in. lengths, replaced on the lumber truck and delivered to the car. These 292 pieces are then treated with a waterproofing compound on both the tongue and groove, a linear distance of 292 pieces by 4 ft., 1 in. by 2 sides, or a total of 2,380 linear feet that must be waterproofed. It is then necessary for the carpenters again to handle these 292 pieces in applying to the car.

* Abstract of a paper presented at the March 16 meeting of the Car Department Association of St. Louis. The author is storekeeper of the St. Louis Refrigerator Car Company.

My purpose in mentioning these 292 pieces so often has been to show the wide disparity in comparison to plywood. There are only 12 pieces of 4-ft. by 8-ft. plywood required for this drain floor, requiring the handling of only 12 pieces from the car in which it is received to the stock pile. As there is no billing whatever required, all labor involved in removal from the stock pile, loading on a lumber truck, delivering to the mill, milling and reloading on the lumber truck is eliminated. In waterproofing the edges on plywood, there is a linear distance of only 12 pieces by 4 ft. by 2 edges, or a total of 96 linear ft. involved. In the actual application to the car the carpenters also handle only 12 pieces.

Savings in Application Cost

Similar savings are realized on the bottom floor, where 10 pieces of plywood are used in place of 90 pieces of tongue-and-groove flooring; on siding where 20 pieces of plywood are used in place of 260 pieces of tongue-and-groove; on inside lining, where 36 pieces of plywood are used in place of 98 pieces of tongue-and-groove; on the ceiling, where 12 pieces of plywood are used in place of 72 pieces of tongue-and-groove, and on the roof sheathing where 12 pieces of plywood are used in place of 72 pieces of tongue-and-groove.



Plywood panels stacked in a railway shop ready for use in rebuilding freight cars

There is also a saving in labor in the application of plywood in comparison with tongue-and-groove lumber. If you will visualize the application of one large sheet of plywood and then the many small pieces of tongue-and-groove lumber, the savings involved are obvious. The illustration on drain floors holds true in the same proportion with respect to the application to the car, as well as on the bottom floor, siding, inside lining, ceiling, roof sheathing and all insulation.

It is worth while to mention the fact that on the first lot of new cars which we constructed entirely of plywood, we used approximately 19 per cent less nails than on a similar car constructed of tongue-and-groove lumber.

Again, after discussing the savings in application cost, the additional savings in handling cost should be considered in the light of critical man hours saved.

Air Brake Questions and Answers

HSC High-Speed Passenger Brake Equipment

189—*Q.—Describe the action when speed reduces to approximately 20 m. p. h.* A.—Relay *2-L* drops out, thus opening its contact *2-LA*. The opening of this contact removes the short circuit around relay *2-L*, allowing it to be energized. The closing of contact *6-D* energizes the low speed (L) *F.S. 1864* relay magnet, thus developing 40 per cent maximum braking force.

190—*Q.—What happens in the event of an open wire from the generator or battery?* A.—All *F.S. 1864* relay magnets are de-energized.

191—*Q.—In this event what braking force is developed?* A.—Sixty per cent maximum braking force, or 150 per cent braking ratio, the same as is used on conventional cars without speed governor control.

192—*Q.—What is used across the contacts of the relays which control the FS-1864 magnets? Why is this necessary and when?* A.—Arc suppressors are used to protect the contacts of the relays which control the *FS-1864* magnets, these contacts being on relays *6* and *6-M*. This is necessary to protect the contacts of these relays when the speed governor equipment is used to handle the FS-1864 relay magnets throughout the train. If individual speed governors are used on each car, the arc suppressor is not necessary.

193—*Q.—Of what do the arc suppressors consist?* A.—Resistors *13* and condensers *14*, shown in Fig. 14. Condensers are connected across the contacts of relays *6* and *6M* and are used to extinguish the arc caused by the circuit being opened. The resistors are connected across the magnets and serve to limit the high voltage induced when the magnet circuit is opened.

194—*Q.—What does the speed governor afford protection against?* A.—The development of braking force in excess of that which is practical for varying speed.

195—*Q.—How is the speed governor equipment tested?* A.—By means of a test set furnished by the manufacturer.

Installation and Maintenance of Axle Generators

196—*Q.—With how many types of drives are the generators provided and what are they?* A.—Two types; *A* and *B*, shown in Fig. 10A.

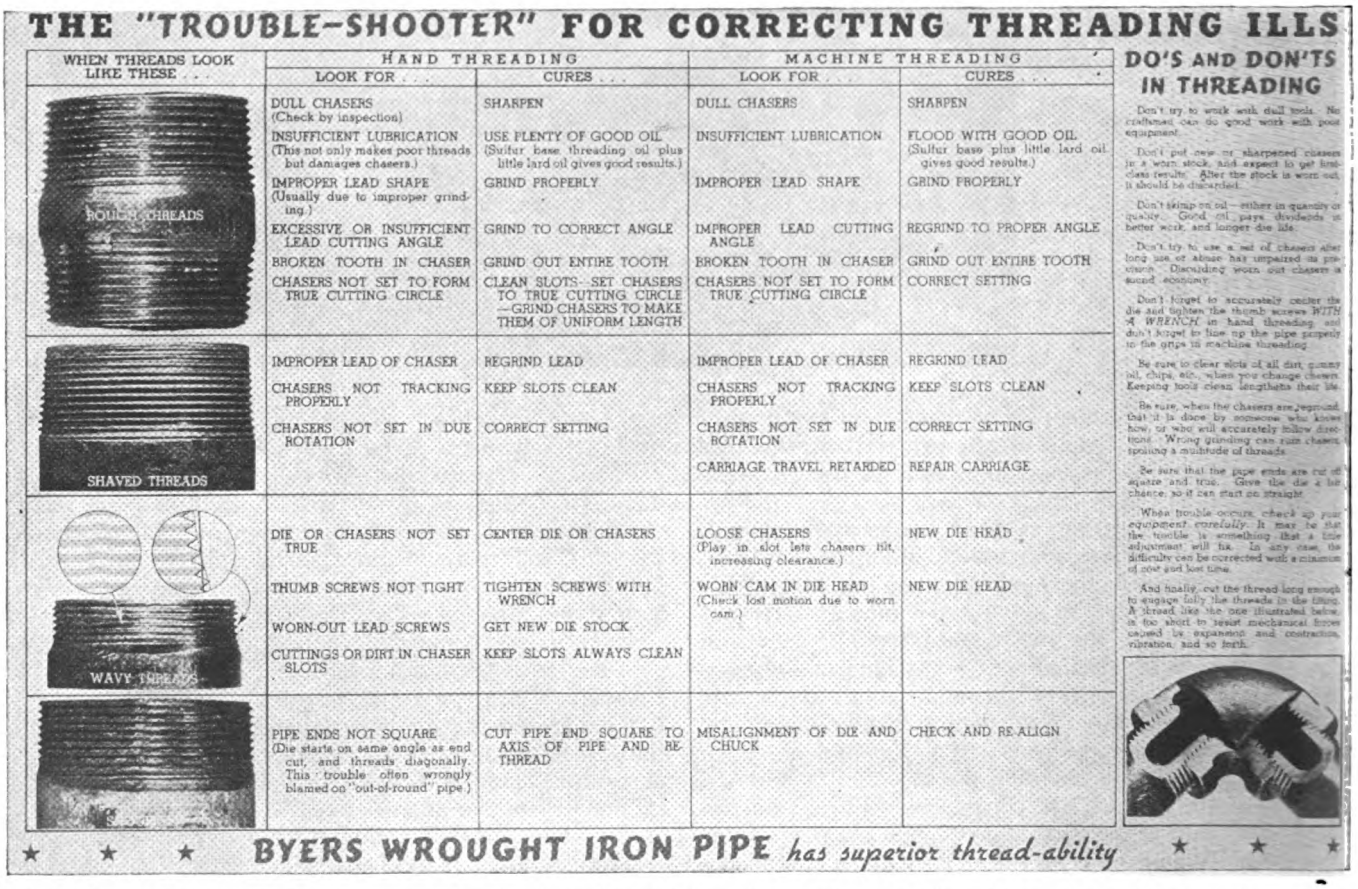
197—*Q.—What does the type A consist of?* A.—A splined drive shaft (Ref. 5—Fig. 10), engaging a spline bushing centered in the end of the axle and is used chiefly on bearings having axle thrust plates.

198—*Q.—What does the type B drive consist of?* A.—The type B drive is used in journal boxes not having axle thrust plates and consists of a crank arm and coupling plate (Ref. 13—Fig. 10), fastened to the armature shaft and two driving studs (Ref. 11—Fig. 10A), threaded in the end of the axle and engaging in slots in the coupling plate.

199—*Q.—Describe the method of installation with the type A drive.* A.—The spline shaft (Ref. 5—Fig. 10), for the type *A* drive has been assembled at the factory to the generator with which it is shipped and the thickness of the laminated shim (Ref. 3—Fig. 10) has been adjusted for the proper drive shaft fit. It is important that the serial number marked on the drive shaft corresponds with the number of the generator to which it is assembled. To assemble the shaft to the generator, first remove and discard the lock nut from the end of the armature shaft. Engage the tongue of the drive shaft in the slot in the end of the armature and thread the coupling cap (Ref. 4—Fig. 10) securely in place and lock by means of the lock washer (Ref. 2—Fig. 10). Securely holding the splined end of the drive shaft during this operation will prevent rotation of the armature and permit proper tightening of the cap. After assembly, the drive shaft should be free but without end play. If end play is present check the coupling cap to see that it has been drawn up tight. If this has been properly done and end play still exists remove the coupling cap and drive shaft and adjust the thickness of the laminated shim washer by peeling off a number of shim thicknesses sufficient to give the proper fit as described above. The splined plug in the end will have been installed by the axle manufacturer and requires no adjustment other than to see that the spline members engage correctly.

200—*Q.—Describe the installation of the type B drive.* *A.*—Generators using the type *B* drive are shipped from the factory with the drive completely assembled and for installation require only the mounting of driving studs on the end of the axle. Depending on the individual installation the drive studs may be mounted directly in the end of the axle or on an intermediate mounting plate bolting to the axle or the axle bearing locking means. Several arrangements of drive studs are shown in Fig. 10A. Detailed information regarding mounting is given on the drawing for the individual application and this must be closely followed in making the installation. Where the application requires drive stud spacing other than 4 in., it is important to check the coupling ring (Ref. 13—Fig. 10) to ascertain that it is suitable for the drive stud spacing being used. So that this may be readily determined, coupling rings usable with stud spacing from 3½ in. to 4 in. are marked with the painted number 3 or stamped 3½-4.

* * *



Industry is cooperating with shop management in the preparation of informative material to aid in training workers—The chart shown is an example and is one of four prepared by the A. M. Byers Co., Pittsburgh, Pa.—Similar charts are available to inquirers on the subjects of pipe bending, plate bending, and flame cutting and welding—Booklets on all subjects covered by the charts are also being furnished for use in instruction courses

Jig for Use in Welding Center Plates

Scrap material, available around any car shop, can be used to build a jig which will facilitate the welding of cracked center plates. The base of the jig can be made from a scrapped brake wheel and other portions made from scrap plate or bar iron. A joint is provided to allow a 180 deg. movement of the table plate in the vertical plane and an additional joint allows full turning of the jig table through 360 deg. without reference to its position vertically. End bar clamps fasten the center plates firmly in position on the working table and an additional clamp through the pin opening aids in holding the center plate firmly against the table surface and helps to prevent any distortion which might result from the welding heat.



Scrap material can be used to construct a jig which permits positioned welding on center plates

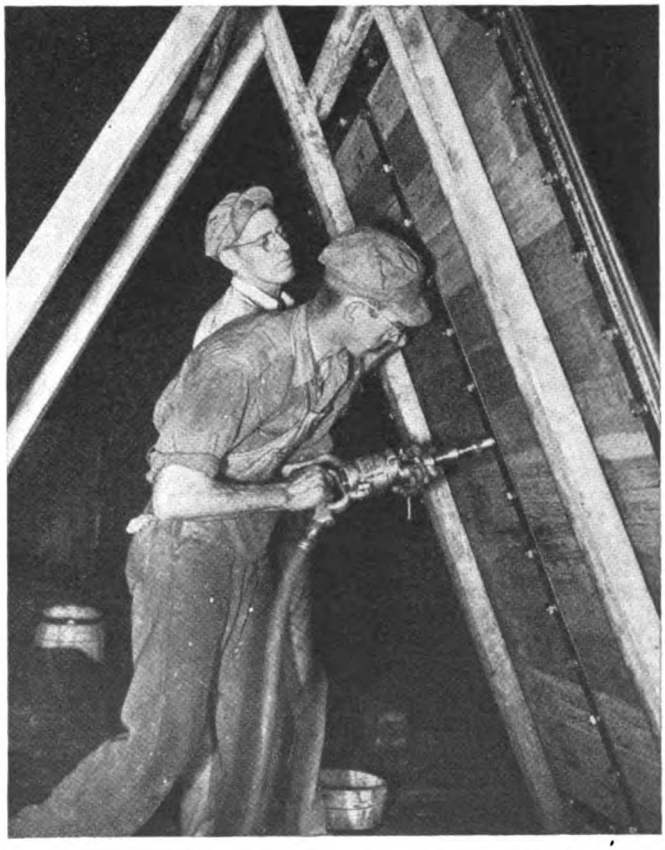
Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Home Shop Movement Authorized On Owner's Responsibility Damage

Under date of August 2, 1938, the Reading Company advised the North American Car Corporation that it was holding NADX car No. 1022 at Hershey, Pa., with defective center sills and requested disposition and routing. The North American Car Corporation on August 4, 1938, asked for full information as to the nature and extent of the damage to the car; also the responsibility therefor. On August 9, 1938, the Reading Company advised the owner that center sills were buckled 2½ in. at the center of the car, owner's responsibility, and recommended authorization to forward the car to home shop for repairs, the car to be handled on rear end of train to prevent further damage. Authority was given and the car moved via the Reading, Pennsylvania and Chicago & North Western to Baraboo, Wis., arriving there on September 7, 1938. Subsequent joint inspection revealed that the center channels and side sills were bent 2⅝ in. On October 7, 1938, the Reading Company was requested to assume responsibility and forward defect cards. Other correspondence revealed that the Reading's car foreman and car inspector had made actual measurements with a straight edge and found the sills to be buckled 2⅜ in. with the side sills deflected downward 3 in. The claimant company relied on this discrepancy in the figures given in correspondence and on the fact that the construction of the car made it impossible to take accurate measurements on the center sill to establish handling line responsibility. When the Reading refused to issue defect cards it wrote that it was taking up the matter of issuing a defect card with the Susquehanna & New York, which road had delivered the car to the Reading. This fact was relied on by the claimant to establish that the sills must have been buckled in excess of 2½ in. when the car passed interchange. The claimant also questioned the Reading's action in reporting the car, although Rule 44 does not so require when damage is not over 2½ in. The Reading pointed out that its action was within the spirit of the rules and gave the car owner an opportunity to examine the car if it was not satisfied as to responsibility before ordering the car home. Failure to do so was construed

* * *



Special jig used in a car builder's shop for making box car doors

as acceptance of the statement as to owner's responsibility. The history of the car showed that note was made of sills bent by the Susquehanna & New York when it received the car from the Lehigh Valley, that the Reading made a similar record when it received the car and that the Pennsylvania accepted it for home bound movement without requesting a defect card. The Reading contended that the defect was a progressive one and that it should not be penalized for the 3-in. deflection noted at Baraboo, Wis., after the car had journeyed about 1,000 miles with a 2⅜-in. deflection.

In a decision rendered November 6, 1941, the Arbitration Committee ruled against the complainant stating: "When the car owner ordered the car home for repairs without having the car inspected and without questioning the Reading's statement that the sills were not bent in excess of 2½ in., it is considered as being equivalent to acceptance of statement of the handling line. The principle of Rule 45 applies. The contention of the Western Refrigerator Line Company is not sustained."—*Case No. 1787, Western Refrigerator Line Company vs. Reading.*

Claim Against Trunk Line For Car Damaged on Switching Line

The Hoosac Tunnel & Wilmington received SHPX car No. 10817 on September 16, 1938, and spotted it on a plant siding. A flood occurred and the car was washed into the river along the railroad. The trucks lodged in the bank and later served as rip-rap in rebuilding operations. The tank and underframe were washed down the river and piled up with other cars along tracks of the Boston & Maine. In salvage operations the latter company assumed the car to be one being handled by it at the time of the flood and reported its destruction to the owner under Rule 112 asking for the depreciated value. Later the true circumstances were discovered and reported to the car owner. The B. & M. disclaimed responsibility because the car had been delivered as billed and was in possession of the H. T. & W. at the time of the flood. The car owner relied on Rule 113 as establishing the responsibilty with the B. & M., while that road's interpretation of Paragraph 2, Rule 113, relieved it of responsibility in view of the car in question being a private car not "owned or controlled by a railway company."

On April 23, 1942, the Arbitration Committee found in favor of the railroad, saying: "The owner of the private line car in question admits the car was in possession of the Hoosac Tunnel & Wlmington at the time of its destruction. Under the provisions of Rule 113 in effect at that time the Boston & Maine is not responsible."—*Case No. 1788, Boston & Maine versus Shippers' Car Line Corp.*

Precooling Air-Conditioned Cars From Terminal Stand-By Facilities

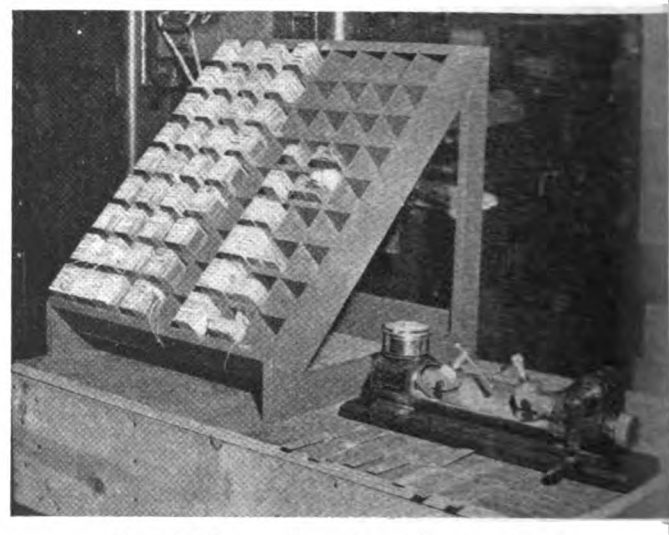
The New York, New Haven & Hartford and the Boston & Maine operate passenger equipment of both lines' ownership in through service between points on the two roads. The cars are equipped with electro-mechanical air-conditioning systems and are precooled at Grand Central Terminal before departure from New York. The New Haven cars are provided with receptacles to permit precooling with current from an outside source; the B. & M. cars are not so equipped and it is necessary to use current from the car battery. The B. & M. pays the entire cost for charging batteries on its cars when this work is performed by the New Haven. In addition to this charge the New Haven also billed the B. & M. for its proportionate share of the current cost of precooling receptacle-equipped cars of New Haven ownership. The B. & M. refused this billing on the ground that New Haven cars could be precooled by battery current and that, in effect, the charge for outside current to the B. & M. represented a proportionate share of the cost of recharging New Haven car batteries, which under P. C. Rule 9, Paragraph 3, is at owner's expense. The New Haven contended that, under the same rule, the charge was a proper line service expense.

In a decision rendered November 13, 1942, the Arbitration Committee ruled that: "The cost of precooling cars by electric current furnished from stand-by facilities is a line service expense. The roads involved in the line should agree on the cost of such service and each should assume its mileage proportion of such cost. The contention of the New York, New Haven & Hartford is sustained."—*Case No. 1789, Boston & Maine versus New York, New Haven & Hartford.*

Testing Spot Welds For Shear Strength

A quick, simple method for shop testing the strength and soundness of spot welds has been developed in the East Springfield, Mass., plant of the Westinghouse Electric & Manufacturing Company. Spot welding is usually tested by "pulling a button" but this only tells if the material is actually welded, failing to give any measure of strength or soundness of weld.

A small shear-testing machine is now used to make a thorough test. When an inspector desires to make such a test he takes two standard test pieces, cleans the surfaces and makes the weld by overlapping the two pieces. The welded specimen is then clamped in the machine and subjected to shear. The force applied in pounds is shown by a gage on the machine. A prepared chart shows the minimum strength required for the various thicknesses and types of material.



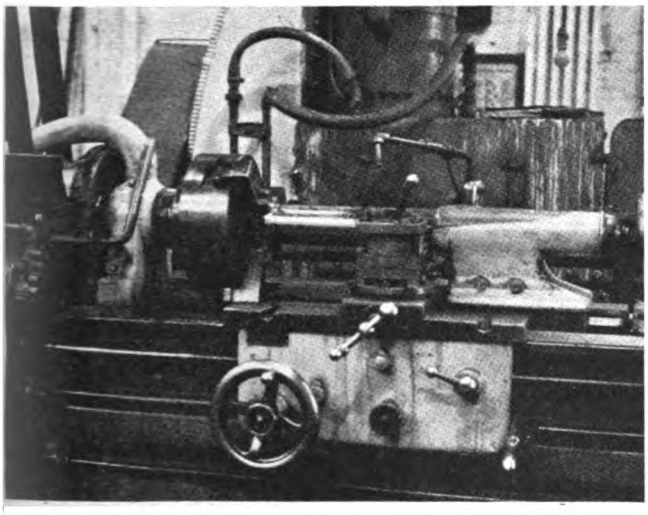
Shear testing machine and rack for test pieces

Advantages gained from the use of the shear-testing machine are: (a) aids in control of quality by giving a quantitative value of the strength of the weld; (b) serves as a quick check on setup of spot welder; (c) compact and simple to operate; and (d) permits tests to be made by operator or floor inspector instead of a laboratory technician.

IN THE BACK SHOP AND ENGINEHOUSE

Pin Turning on a Production Basis

An old engine lathe has been converted into a single-purpose machine at the Meadville, Pa., shops of the Erie. Faced with a demand for pins of the many various sizes required for repair purposes, this production plant now is able to furnish all that are needed without the necessity of setting up work on any of the more modern tools



An old engine lathe, an air chuck, a turret lathe tool post and Carboloy tools make an efficient pin turning unit

in the shop. An air chuck was mounted on the lathe and a Carboloy tool in a turret lathe tool holder is used for machining operations on the forgings received from the blacksmith shop. The lathe is operated at 240 r. p. m. with a feed of $\frac{1}{32}$ in.

Ten Commandments for Diesel Maintenance*

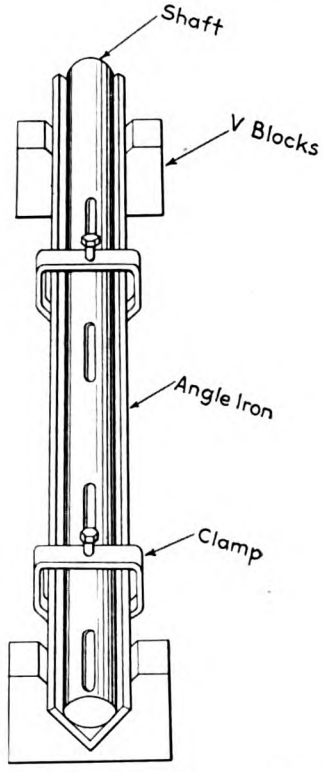
1. Thou shalt keep thine engine clean and in adjustment that thy life in its company shall be long and that the owner shall increase thy pay.
2. Know thine engine and all its parts and functions, else thou shalt be in some unholy spot.
3. Be not wise in thine own conceit. Remember the factory instructions and keep them holy, lest repairs be thine undoing.
4. Be not loose in thy jaw hinges for no man knoweth all about Diesels. The truly wise absorbeth much knowledge and exulteth little, and he who so doeth shall gain repute among his fellows and favors among his superiors.
5. For all things in this life that thou desireth thou shalt also pay plenty and for the wisdom of experience, no less. Advice from the multitudes costeth nothing and is usually worth just that.
6. In the books thou mayest read what to do and when, but only the voice of experience may tell thee why and how, else thy reading of what and when shall but plague thee with smoke.
7. God maketh the earth to rotate endlessly without bearings, or oil, but not thy Diesel.
8. Curse not thine engine when it turneth not. Curse rather thine own stupidity.
9. Steam engines and gas engines may long turn over though sloppy; a Diesel not so. With gages and mikes be thou ever busy.
10. The eternal eye watcheth universal operations, but thou shalt not rely upon it as to thy Diesel. Thine own vigilance is the price thou payest for thy job.

* Prepared by W. C. Conder, chief machinist's mate, U. S. S. Trapnal No. 125 U. S. A., and widely used and distributed by the Electro-Motive Division, General Motors Corporation.

Small Machine Gives Large Spliner Results

A simple angle iron fixture developed at General Electric's Schenectady Works overcomes the problem of misalignment in cutting the keyways in a 3-in. diameter, 6-ft. long cam shaft, and permits a small machine to do a job ordinarily requiring a large spliner.

Previously, even with the utmost care, the operator



Accurate machining of keyways is assured by the use of this fixture

was unable to machine the keyways so that they did not need correction. Most of the error was caused by the fact that only one or two keyways could be cut with one setup.

The angle iron fixture which eliminated these difficulties was planed on its four surfaces, and clamps were made for holding the shaft in place in the angle. Two keyways are cut, and then the shaft and fixture moved along in the vee blocks to the next setting. With the work done while the shaft is held in the fixture, the keyways are in line and remain that way after the shaft is straightened.

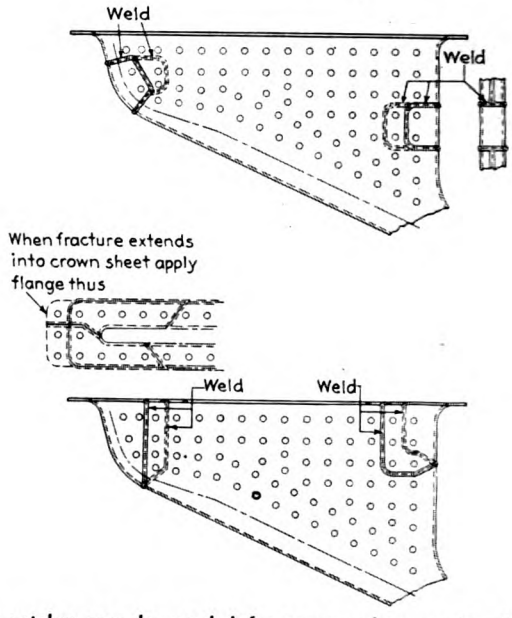
Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

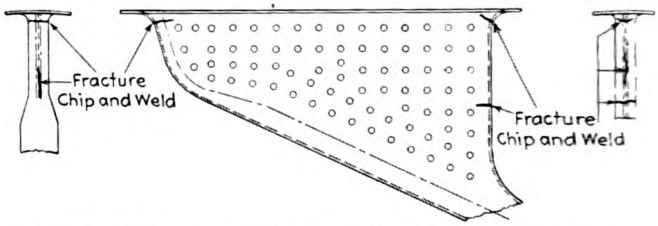
Welding Cracked Thermic Syphons

Q.—What methods are used for repairing cracks in the front or back of thermic syphons? These cracks have developed in the semi-circular ends of the syphon under the crown sheet.—E. F. D.

A.—Fractures in the front or back of thermic syphons are repaired by chipping out the fracture and then welding. The procedure is shown in the illustrations.

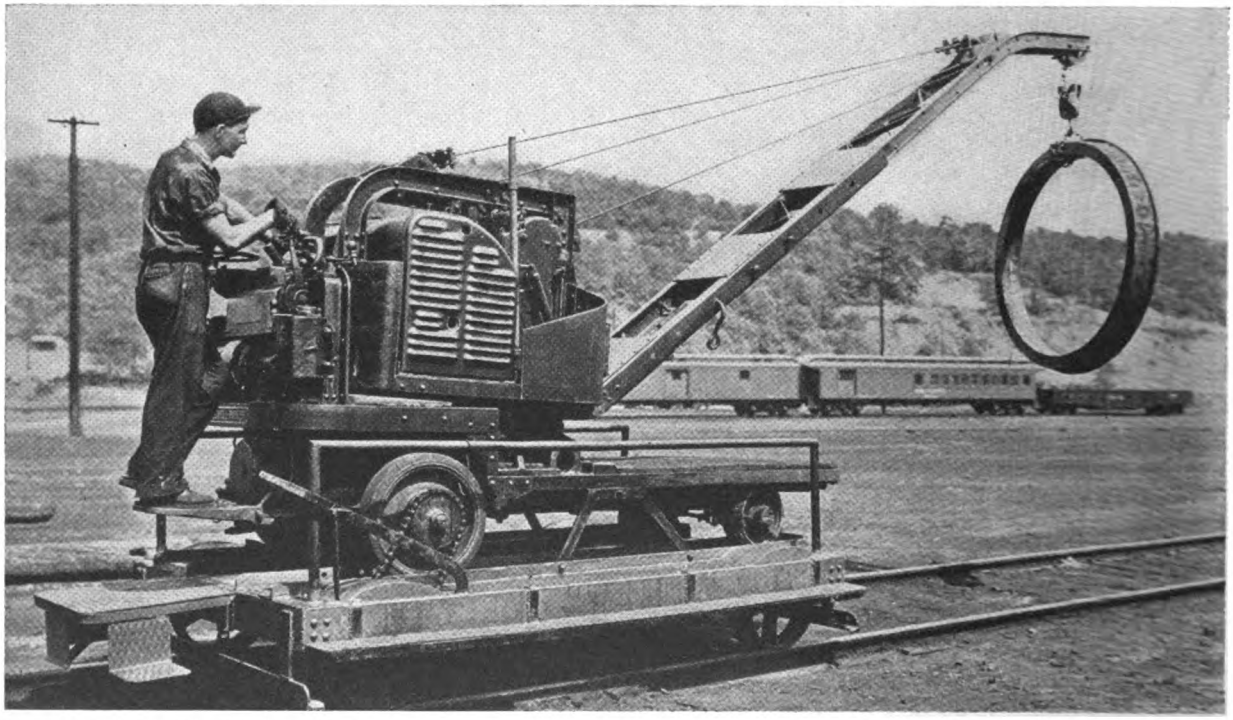


Welded patches may be needed for some syphon repairs—Locations where patches are required should be properly prepared before welding is begun



Welding alone will usually be satisfactory in repairing cracks in syphons

* * *



Courtesy of the Reading-Jersey Central Magazine

Not all the jeeps are in the army

Here is one developed by F. L. Giehl at the St. Clair (Pa.) enginehouse of the Reading. An Elwell-Parker crane truck is mounted on a four-wheel standard gauge truck. Used for loading, unloading and handling materials. The power take-off of the truck propels the car and if the truck crane is needed for delivering material in the enginehouse it is removed from the car by a ramp and then goes to work as an ordinary crane truck.

Welding Piston Rod Nuts

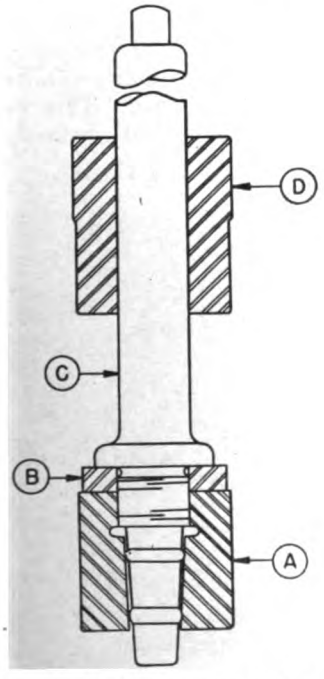
Q.—We are having trouble with loose piston followers. Do you know of any method whereby these may be kept tight?

A.—The following will be found to be a satisfactory method of correcting this trouble. The bull ring must be removed before the method is used. Presuming that the taper of the rod is the usual ¾ in. in 1 ft., the new piston rod is turned and tried until the follower goes into the fit to a distance of 5/16 in. from the shoulder. The rod and follower are then taken to the wheel press and the press arranged so that pressure may be exerted on the crosshead end of the rod. The follower is heated thoroughly and while hot slipped quickly onto the fit. The assembly while still hot is lifted into the press and a pressure of about 50 tons is applied to hold the follower and prevent it from backing off the fit as it cools. When the piece is cool enough to handle the nut is applied and tightened with a sledge and handle bar. The rod and follower are then up-ended and a heavy bead of coated rod welded around the junction of the rod and nut. Chamfering the rod and nut before application aids in getting depth and penetration in the weld.

Sizing Reamer For Restricted Locations

*By Henry Bernadt**

A repetitive production tool devised at General Electric's Schenectady Works quickly and accurately reams holes in restricted places that are difficult to reach with scrapers. The tool is essentially an expansion reamer, and the drawing shows the unit set up for operation.



Sizing reamer for holes in restricted locations

When it is set up for production, the unit is first disassembled, an operation that reduces the diameter about 0.002 in. The reamer *A* is inserted in the hole to be finished, and tightened against a washer *B* by a twist of the arbor *C*. This expands the tool to the proper diameter and reams the hole to the correct tolerance in one turn. Part *D* is a guide member.

Cutter wear is taken care of by decreasing the thickness of the washer. This permits the taper portion of the arbor to further enter the cutter. A 0.001-in. reduction of the washer thickness will expand the reamer 0.0001 in.

* A methods man, General Electric Company.

Locomotive Boiler Questions and Answers

By George M. Davies

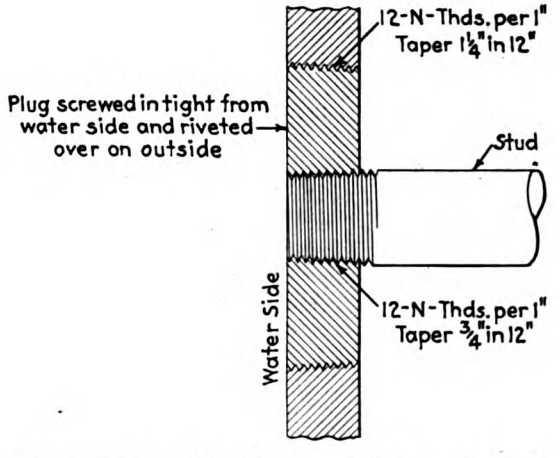
(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Using Oversize Studs

Q.—The feed water pump brackets on our 2-8-2 type locomotives were originally studded to the boiler with 1⅛-in. studs. They have been replaced several times, the stud diameter being 1⅜ in. Is it satisfactory to increase this diameter to 1½ in. on the next installation of studs?—H. E. E.

A.—It is satisfactory to use 1½ in. studs provided there are no cracks running from the stud holes, and if the efficiency between the stud holes does not fall below the efficiency of the longitudinal seam of the shell course involved.

General practice, however, is to limit the size of the stud renewals to 1⅜ in. diameter. The enlarged stud hole is then drilled out and a plug of suitable diameter applied, and the stud is restored to its original diameter.



Preferred method of applying new studs in oversize holes

The diameter of the plug which can be applied before reinforcing is necessary is governed by the following rules:

It is not necessary to reinforce holes up to 3¼ in. in diameter, except injector check and blow-off cock holes.

Holes over 3¼ in. in diameter, the diameter of which

exceeds 4½ times the thickness of the plate, should be reinforced.

Holes over 3¼ in. in diameter, the diameter of which does not exceed 4½ times the thickness of the plate, need not be reinforced.

When there are other holes near the oversize stud hole which require a plug, or in the event that there are two or more oversize stud holes in one particular zone which require plugs, it will be necessary to calculate the efficiency in order to ascertain whether or not the holes can be plugged.

At no time should the diameter of the stud hole in the plug exceed a diameter by which the wall thickness of the plug around the stud hole is reduced below the thickness of the plate plus ⅛ in.

At no time should the efficiency of the plate between the plugs be less than the efficiency of the longitudinal seam of the shell course involved.

Calculating Boiler Braces

Q.—Will you kindly publish a set of rules for calculating locomotive boiler braces of both the rod and the gusset type? —F. E. R.

A.—The area of the backhead or front tube sheet to be stayed shall be the area enclosed by lines drawn 2 in. from the outside of the tubes or the center of a row of stays and at a distance D from the shell or wrapper sheet.

The area of the dry pipe holes in the front tube sheet should be omitted from the area as obtained above as it is assumed that this area is supported by dry pipe fastenings and the superheater header.

The valve of D used may be taken as the larger of the following values:

D = The outer radius of the flange, not exceeding eight times the thickness of the backhead or front tube sheet.

$$D = \frac{5 \times T}{P}$$

where

D = Unstayed distance from the shell or wrapper sheet, in.

T = Thickness of backhead or front tube sheet, sixteenths of in.

P = Maximum allowable working pressure, lb. per sq. in.

When the backhead or front tube sheet is supported with both gusset and rod braces the stress on rod braces should be calculated separately from that on the gusset braces.

In calculating stresses on braces and their attachments, the angularity of the brace, if in excess of 15 deg., must be taken into consideration. The practice in calculating stresses on braces is to take the entire area supported by either the rod or gusset braces, multiply by the boiler pressure and divide by the sum of the least cross sectional area of all the rod or gusset braces. This method should be followed when the braces are uniformily spaced. If one or more of the braces are so segregated as to receive more than their portion of the load, they must be calculated separately from the rest.

In taking into account the angularity of the braces, the angle of each brace must be found and its section area must be reduced in proportion to the angle that the stay makes with a line drawn at right angles to the surface supported. This is to be done in preference to increasing the load in proportion to the angularity of the brace so as to avoid the necessity of calculating the area supported by each individual brace. The angle of each brace must be ascertained and if it is in excess of 15 deg. the area of the brace must be reduced by multiplying the area of the brace by the cosine of the angle that the brace makes with a line drawn at right angles to the area supported. The line representing the angle of the braces will be the center line of a rod brace, on gusset braces it will be the line intersecting the front rivet in the flange where it is riveted to the wrapper sheet and the bottom bolt in the backhead angle irons where the gusset plate fastens to the angle irons.

Brace rod jaws, brace feet, eyes, pins, rivets, bolts and angle irons should be made stronger than the body of the brace.

Cold or Hot Rivets?

Q.—What are the advantages or disadvantages of using cold drawn rivets, cold riveted, over hot-drawn rivets, hot riveted? —F. E. M.

A.—The advantages of cold-drawn rivets, cold riveted are:

(1) They are formed in solid die machines, have a smooth surface, a round shank, a square end, and are made to close tolerances which enable them to be driven into rivet holes 1/32 in. larger than the rivet.

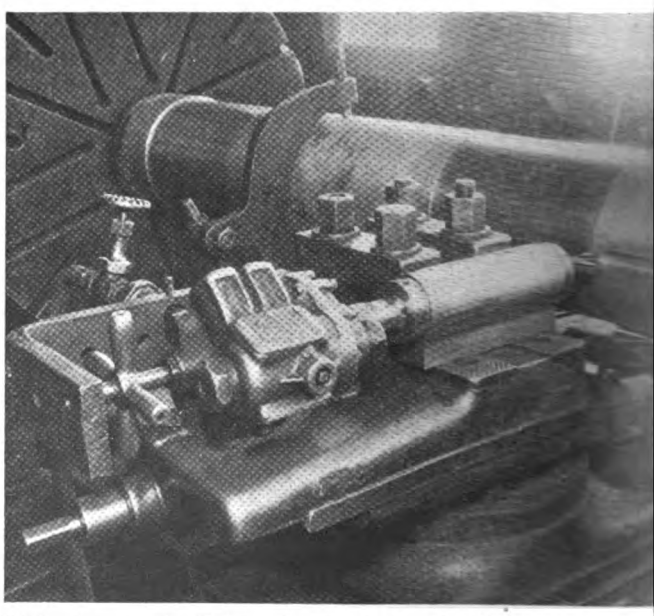
(2) The lower cost of applying cold rivets because they do not require heating.

(3) The lower cost of applying cold rivets because they are easier to handle than hot rivets, and riveting is done faster.

(4) Better fit is obtained because the hole can be reamed smaller without the allowance for expansion needed when using hot rivets.

The possible disadvantage to the use of cold-drawn rivets is the fact that they are limited in sizes. Cold formed rivets are made in diameters from ⅛ in. to 1 in. Standard cold heading equipment has a length limitation of about 4 in.; hence all rivets, regardless of diameter, longer than 4 in. must be hot formed. Cold riveting should be done with either pneumatic or hydraulic riveters of the squeeze type. This requirement also places a limit on the extent to which they can be used.

* * *



Milling keyways in driving axles at the Topeka, Kan., shops of the Atchison, Topeka & Santa Fe—A No. 3 air motor mounted in the tool post of an axle lathe drives a 1¼-in. milling cutter—The axle is clamped in position against rotation





Upper left—In the truck repair pit where workers must operate in teams, Anna Natale, left, and Jennie Pelosi, right, both of whom have brothers in the Armed Forces, carry on in jobs formerly held by men. Upper right—Mrs. Madeline Guarascio, whose husband is now in the United States Tank Corps, operates a four-spindle drill press

Women Take Over

Fill places of husbands, sons and brothers in New Haven electric locomotive shop



Mrs. William Winter. armature winders' helper, works with the winder on a main generator set—Mrs. Winter's husband, now a seaman, first class, was formerly employed by the New Haven in these same shops



With their Marine Corps son, William Grossjung, Jr., fighting the Japs in the South Pacific. Mr. and Mrs. William Grossjung, Sr., devote 100 per cent of their time toward speeding the day when he'll come home—They are shown rebuilding a main transformer



Mary Falkowska, armed with asbestos gloves to protect herself against the hot metal, cleans and tins armature coil copper—Miss Falkowska is taking the place of her brother, formerly employed in these shops and who is now working for Uncle Sam

TURNING THE TABLE

by Walt Wyre

"LOCOMOTIVES should be built with the cab in the middle and a pilot at each end," Ned Sparks, electrician for the S. P. & W. at Plainville, remarked as he dumped a load of tools on the work bench in the electric shop and sat down beside them.

"Might have a little trouble finding a place for the tank," Johnson, another electrician, said. "Besides, what's the idea of wanting a locomotive to look like a two-headed calf in a side show?"

"Turntables!" Sparks snapped. "They are more grief than anything else at a roundhouse! When they will run, they can't be stopped long enough for maintenance; when they won't run, everybody is anxious as an expectant father pacing a hospital hall."

"That's right," Johnson agreed, "but I don't see any use worrying about it. The roundhouse foreman chewed half a plug of horseshoe in the two hours the table was stopped this afternoon, but if it hadn't broke down he would have needed some other reason for delays.

"The 5092 was called for 5:30 and wasn't even fired until 5:10. It had only about ninety pounds of steam when the hostler took it out of the house right after we finished patching the controller. Hope it hangs together until morning, the controller, I mean," Johnson added.

"Yeah, so do I." Sparks slid from the bench and started peeling off his overalls. "A new controller was ordered about eight months ago. The storekeeper told me last week it had finally been shipped."

"Well, it sure is needed," Johnson remarked as he left the shop.

Sparks hung up his overalls, placed the tools in a drawer and headed for the time clock.

NEXT morning about ten o'clock, the turntable quit again. Jim Evans, the roundhouse foreman, found Sparks. "Get it going as soon as you can. There are three engines called and two to put in the house," the foreman told Sparks.

The trouble was in the controller again, broken spring on one of the contactor fingers. Sparks went to the storeroom for a new spring and wasn't surprised when there wasn't one.

"There is a whole new controller, though," the storekeeper told him.

"Can't use it right now," Sparks said. "What I need is a spring like this, only not broken."

After a few minutes search, a spring was found that while not identical with the broken one would answer the purpose. It didn't take long then to get the table turning again. Then Sparks told Evans about the new controller and asked him when would be a convenient time to put it on the turntable.

"There isn't such a thing as a convenient time to tie up the turntable," Evans said. "How long will it take to install the new controller?"

"About ten or twelve hours, if we have good luck."

Evans groaned. "Well, guess we might as well figure on doing it. Let's see—today is Friday—how about Tuesday?"

"That's O.K. by me," Sparks agreed. "We'll figure to start on it at eight o'clock Tuesday morning."

Sparks turned to leave, but was stopped by John Harris who came out and handed Sparks a traingram from the master mechanic's office.

The electrician read the message and swore.

"Bad news?" the clerk asked.

"Not so bad I can't bear up under it," Sparks told him. "The motor on the new well at Sanford keeps stopping. The water service supervisor claims it's low voltage."

Next morning Sparks went to the master mechanic's office and showed him the traingram. H. H. Carter, master mechanic for the Plains Division, read the traingram, then asked, "What will it take to correct the trouble?"

"Well," Sparks replied, "if the trouble is low voltage as the water service supervisor claims, I have an idea the line wires should be larger. We have never had any trouble with low voltage at Sanford before and the line wires are small enough that it could be voltage drop causing the controller to kick out."

"Maybe you had better go to Sanford Monday and fix it. How long will it take?"

"Oh, Johnson and I should be able to change the wires in one day." Then Sparks remembered about the turntable controller to be installed Tuesday.

"Well," the master mechanic hesitated a moment "maybe you had better go to Sanford Sunday evening. That will give you all day Monday and you can come back Monday night on the Limited."

That being settled, Sparks went back to the electric shop. He found Johnson bending a goose-neck of half inch conduit and asked what it was for.

"You know Evans has been hollering for a light at the east end of the grease house," Johnson explained. "I thought I might as well put it up while there was a little time."

"O.K.," Sparks agreed with the idea. "We've got to go to Sanford Sunday and run heavier line wire to the new well motor."

"What's the matter, won't that number eight we run hold the poles up?" Johnson laughed, thereby indicating he had just pulled a good joke.

Sparks ignored the Hopish attempt and said, "I figured number eight might be slightly small for the line when we put it up, but it was all we had at the time. We've got some number four now. That will be plenty large, besides, we need some eight to run for lights in the new yard office they are building at Sanford. You go ahead with your light. I'll see about shipping the wire and tools."

AFTER the material was ready to go, Sparks asked the store department truck driver to haul the turntable controller, resistors, and a roll of number four rubber covered wire to the electric shop. He uncrated the controller and resistors and was examining the controller when Johnson came in.

"Need any help on the light?" Sparks inquired.

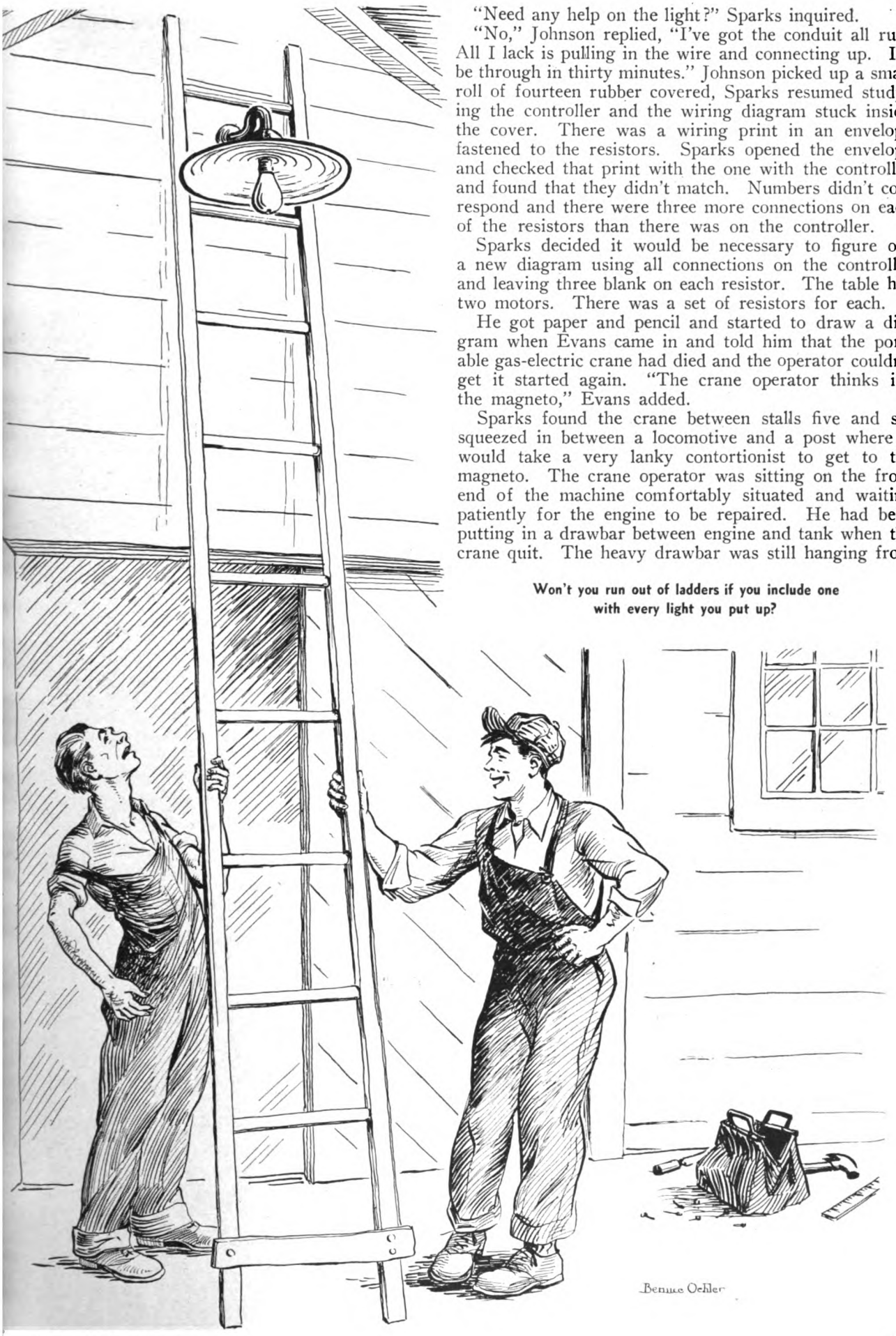
"No," Johnson replied, "I've got the conduit all run. All I lack is pulling in the wire and connecting up. I'll be through in thirty minutes." Johnson picked up a small roll of fourteen rubber covered, Sparks resumed studying the controller and the wiring diagram stuck inside the cover. There was a wiring print in an envelope fastened to the resistors. Sparks opened the envelope and checked that print with the one with the controller and found that they didn't match. Numbers didn't correspond and there were three more connections on each of the resistors than there was on the controller.

Sparks decided it would be necessary to figure out a new diagram using all connections on the controller and leaving three blank on each resistor. The table has two motors. There was a set of resistors for each.

He got paper and pencil and started to draw a diagram when Evans came in and told him that the portable gas-electric crane had died and the operator couldn't get it started again. "The crane operator thinks it's the magneto," Evans added.

Sparks found the crane between stalls five and six squeezed in between a locomotive and a post where it would take a very lanky contortionist to get to the magneto. The crane operator was sitting on the front end of the machine comfortably situated and waiting patiently for the engine to be repaired. He had been putting in a drawbar between engine and tank when the crane quit. The heavy drawbar was still hanging from

Won't you run out of ladders if you include one with every light you put up?



the crane hook. A machinist and helper, their work stopped by the crane quitting, had climbed up in the engine cab to wait and watch while the crane was being repaired.

Sparks surveyed the situation and decided it would be necessary to move the crane back at least a couple of feet before he could get at the magneto.

"If you'll get a chain hoist, I'll get Johnson to give us a hand here," Sparks told the crane operator.

JOHNSON had just finished the light and stepped back to admire the job when Sparks got there. "Pretty neat, eh?" Johnson said when Sparks came up.

"Not bad!" Sparks glanced at the light, then looked more closely. "Won't you run out of ladders if you include one with every light you put up?"

"What do you mean 'run out of ladders'" Johnson asked, then said, "Well, I'll be damned!"

The ladder had been leaning against the building when the electrician had put the conduit through the wall. He hadn't noticed that the conduit was between the rungs of the ladder. The reflector was too large to pass between the ladder rungs, which left three choices: leave the ladder there, saw out a rung, or remove the reflector so the ladder could be lifted off.

Johnson, grinning sheepishly, started to climb the ladder to remove the reflector when Sparks told him about the crane.

"If you tell anybody about that ladder, I'll kill you," Johnson threatened, as they walked back to the roundhouse.

"Oh, I won't tell anybody," Sparks promised, "and if anybody asks me how the ladder got hung on the conduit, I'll tell them it's a new way of keeping ladders from getting lost."

The crane operator was waiting with a chain hoist when the two electricians got back to the crane. They hitched one end of the hoist to a post and the other to the back of the crane and pulled the machine back a couple of feet.

"Turn the engine over," Sparks said to Johnson.

Johnson cranked while Sparks held a screw-driver about a sixteenth of an inch from a plug terminal and the point of the screw-driver resting on the cylinder head. There wasn't any spark. He tried all four plugs the same way with the same result.

"Looks like the magneto is bad," Sparks said.

"That's what I thought," the crane operator said. "It's been missing and hard to start several days."

Sparks removed the magneto from the engine and took it to the electric shop. The points were slightly burned, but not badly. He dressed the points and adjusted them, then tested the magneto by placing a wire in the distributor connection and held the other end of the wire about a quarter of an inch from the magneto while Johnson turned the magneto.

"That spark is hot enough to burn a wet dog," Johnson commented as he watched.

"Well, let's see what it will do on the crane engine," Sparks said.

Johnson cranked until he was worn out, then the crane operator tried it. The engine tried feebly to start several times, but never quite made it.

"How are the spark plugs?" Sparks asked the crane operator.

"Don't know," the crane operator admitted, "haven't looked at them lately."

"I'll go to the storeroom and see if they have any new spark plugs," the crane operator said.

Sparks removed the plugs and tested them by laying them on top of the engine with the wire connected while Johnson cranked. Two of the plugs wouldn't fire at all, one fired feebly across the points, while the other one fired up in the shell of the plug.

"That's the trouble," Sparks said.

The crane operator returned from the storeroom empty handed. "The storekeeper called several places in town and none of them had any plugs that will fit," the crane operator said. "We might get these cleaned and tested up town," he added.

"Well, whatever it takes, get it going soon as possible," Jim Evans, who had come up, added his bit to the discussion.

Two of the spark plugs were still bad after being cleaned. The garage man found two second-hand plugs that tested O.K. When the four good plugs were in the motor, it ran O.K. and everybody was happy again.

Johnson went back and removed the reflector so he could get the ladder off the conduit in one piece, then replaced the reflector while Sparks did a few odd jobs.

SUNDAY evening the two electricians went to Sanford. Monday morning at eight o'clock they were ready to go to work renewing the line to the pump motor, but water was low in the tank and they couldn't shut down the pump. It was one o'clock before Sparks and Johnson started taking down the line and everybody from the call boy to the trainmaster wanted to know how long the pump would be shut down.

"Do you suppose we will get it done in time to catch the Limited back to Plainville?" Johnson asked Sparks.

"We should be done by 6:30."

"The Limited is due to leave at 6:20 but it's been running anywhere from one to four hours late."

At 6:45 the last connection was made and they were ready to start the motor. Sparks came down the pole and took off his hooks.

"Have you heard how the train is?" Johnson asked as he started over towards the switch.

Before Sparks could reply a locomotive whistle answered the question.

"Turn the motor on; if it runs in the right direction we can just make it," Sparks said as he began gathering tools.

Rotation was wrong and the Limited left before they were ready to go. An extra freight called for 8:30 left Sanford at 9:45 and arrived in Plainville at 2:30 in the morning.

The two electricians were both red-eyed and sleepy next morning when they reached the roundhouse a few minutes before eight o'clock. They expected to find the roundhouse practically empty so they could kill the power to the turntable at once and start removing the old controller. Instead every stall held an engine as usual.

Sparks found the foreman and in spite of being very much out of humor, the electrician managed to speak evenly: "We are ready to start on the turntable."

"What!—I'll swear I forgot all about the turntable!" Evans took a chew of horseshoe and scratched his head. "Say, isn't there some way you can change out the controller without tying up the table ten or twelve hours? I don't see how we are going to run trains without getting engines in and out of the roundhouse. You've helped me out of tight places before. I'm sure you can help me now."

"I don't see how I can do it without shutting down the turntable." Sparks' voice held more sympathy than

(*Continued on page 384*)

Vitamins for Diesel Power

Part II

By Walter H. Smith* and A. H. Candee*

Operating characteristics of the Autoload control for Diesel engines

AUTOLOAD control is, in its fundamentals, the simple differential field system of control for Diesel-electric locomotives (described in the preceding issue) to which has been added a small exciter field regulator to compensate for variations due to electrical temperature change or to changes in engine capacity. The electrical connections are shown schematically in Fig. 7. These connections are the same as those used for the differential field system except that a variable resistor has been inserted in the circuit from the battery to the 4-pole exciter field and some of the permanent resistance has been removed from this circuit. The resistance value in the field circuit is then automatically varied by action of the engine speed governor (as explained more in detail later), being a minimum at all times that the engine is not taking full fuel.

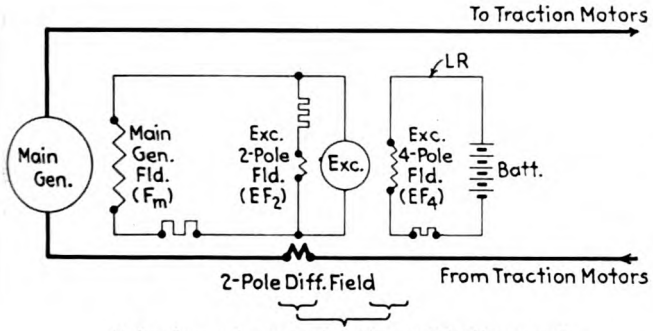


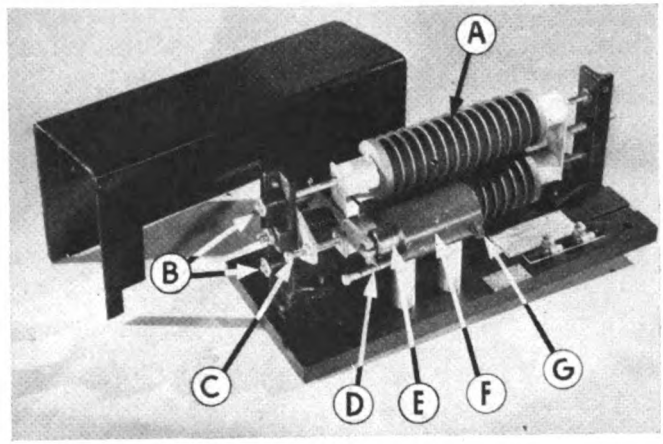
Fig. 7—Schematic wiring diagram for Westinghouse Autoload control

The use of a field regulator in conjunction with the differential field control system allows some modification in the power output setting of the differential system. With the regulator so controlled that an engine overload tends to increase the resistance in the exciter field circuit (to reduce the main generator output), it is feasible and desirable to adjust the differential field control setting so that it will normally try to take excess load from the engine (approximately 15 per cent) with the regulator resistance at its minimum. At the same time, the engine fuel input per cylinder is limited to that which is considered to be a safe maximum operating value so that at no time can the engine actually be overloaded. With these settings, the regulator mechanism is located and adjusted for automatic operation from the engine governor.

In its present form, the variable resistor of the Autoload system is a carbonstat, in which a carbon pile resistor is compressed or expanded by springs through the action of an oil operated piston. With no oil pressure against the piston a strong spring compresses the carbon-pile and reduces its resistance to a minimum. As the piston moves outward under oil pressure, it opposes the strong spring and allows a weaker spring to take effect to reduce the pressure between the carbon discs and thus increase the resistance, this change of resistance being very gradual.

Oil under pressure is admitted to or released from the operating cylinder of the carbonstat by means of a fairly simple pilot valve mounted adjacent to or on the engine speed governor and opened by a projection of the governor fuel arm. The pressure oil for the operation of the carbonstat is usually taken from the supply which actuates the governor.

Autoload control has had its growing pains. When first applied, the carbonstat had complete control of the engine loading, being placed in the circuit between the exciter (not of the differential field type) and the main generator field. Later, to effect a simplification and to improve the reliability, the carbonstat was transferred to the exciter field circuit and the differential field type of exciter was used. The final simplification has removed a compensating piston from the carbonstat and a compensating sleeve from the pilot valve at the governor.



A—Carbonpile
B—Pressure release springs
C—Pressure spring
D—Travel limit indicator
E—Operating piston
F—Operating cylinder
G—Connection for oil pipe from metering valve

Fig. 8—Type TS 31-A Carbonstat

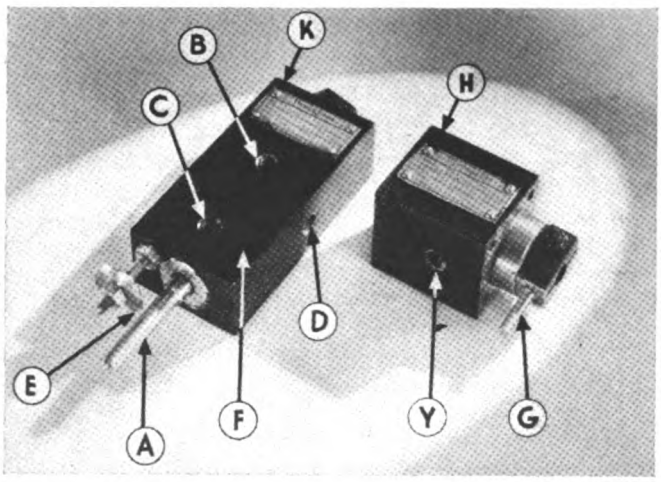
In its present form, the load regulating apparatus of Autoload control consists of three simple devices. The carbonstat is shown by Fig. 8, the pilot valve, located at

* Both Mr. Smith and Mr. Candee hold the position of transportation engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

the engine governor, and the metering valve are shown in Fig. 9. Figure 10 shows the general system of operation in schematic form.

Autoload control is simple. At all times that the engine is not loaded to its full capacity, the plunger *A* of the pilot valve is down below the full fuel position shown in Fig. 10, thus opening the port *B* to the upper chamber *C* of the pilot valve. This allows oil from the carbonstat operating cylinder (assume the metering valve to be in the position shown) to escape to the governor sump and thus causes the pressure spring to squeeze the carbonpile and reduce its resistance to a minimum. As the engine reaches its fully loaded condition, the pilot valve plunger *A* is moved by the governor arm to the full fuel position shown in Fig. 10, thus closing the port *B* and maintaining the operating piston in whatever position it was just before the full load occurred. Excess load causes a slight drop in speed which raises the pilot valve plunger *A* to connect the port *B* to the pressure oil supply chamber *D*. Oil then flows to the cylinder of the carbonstat to force the operating piston outward and thus relieve some of the pressure from the carbon pile. This increases the resistance in the exciter field circuit and continues until the main generator voltage has been reduced a sufficient amount to relieve the engine overload conditions and allow the governor fuel arm (and the pilot valve plunger) to return to its normal full fuel position. This again closes port *B* to hold the load conditions fixed. Any increase in engine speed due to a falling load, then, tends to boost the generator loading and any drop in engine speed due to increased load tends to relieve the load output of the generator.

The metering valve shown by Fig. 10 is used to prevent "hunting" or surging in engine speed. As is the case in nearly every engine loading scheme, there is an inevitable time lag between the indication (by the engine governor) of an overload or an underload condition and the actual correction of load by a change in the generator output. Since the loading conditions may continue to deviate farther and farther from full load during this time interval and thus indicate that more and more correction is needed, there is usually a tendency (unless prevented) to overcorrect the loading which, in turn, makes it necessary to recorrect in the other direction. This overcorrection, first in one direction and then the other, causes "hunting" of the load regulating system and may cause the engine to swing widely in speed several times before settling down to the correct load condition.



A—Pilot valve plunger
B—Controlled oil flow to and from metering valve
C—Leakage oil from metering valve drains into valve body here and flows on through to governor
D—Oil under pressure from governor enters here
E—Guide disc registers with mark on plunger at full lead position
F—Screw holes for bolting pilot valve to governor
G—Rotating portion of metering valve—engine driven
H—Metering valve
K—Pilot valve
Y—Oil to or from operating piston of Carbonstat

Fig. 9—Type UE-618 pilot valve and metering valve

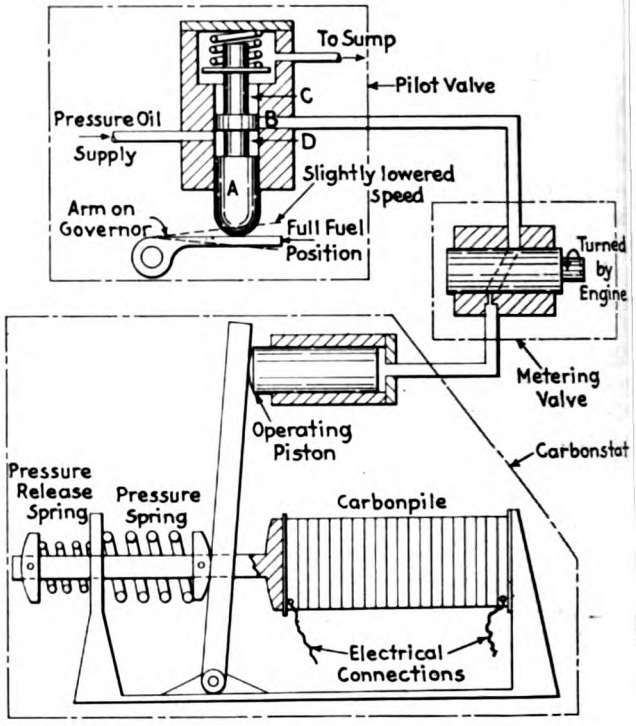


Fig. 10—Schematic diagram of the Carbonstat showing its method of operation

It is the purpose of the metering valve to cause a delay in the operation of the carbonstat so that the change of load will be gradual to prevent overcorrection.

The metering valve, in effect, is merely a rotating cylinder with a hole bored through it, this hole registering periodically with corresponding holes in the metering valve body. The passage of oil from the pilot valve to the carbonstat operating cylinder, then, is not continuous but occurs periodically as the holes in the metering cylinder register with those in the body. Because of this intermittent passage of oil, the metering valve is often called the "spitter." The amount of oil "spit" through per revolution is limited by restricting one of the body ports.

In operation, Autoload control is smooth and utilizes the available engine power effectively. Since the engine output may vary considerably, from a high value obtainable with a new (or reconditioned) engine, cold intake, or high fuel setting, to the low output obtainable from an engine badly in need of repair or adjustment, Autoload control must be able to adjust the generator voltage (and consequently the electrical loading) over a rather wide range. Figure 11 illustrates the approximate limits of electrical voltage control with the engine operating at its full speed. The normal settings are made so that the engine will be loaded to its full capability even though this may vary from about 15 per cent above full load rating down to about 60 per cent rating.

The loading of an engine at speeds below its full operating speed is subject to some limitations. Since the power required for the initial acceleration of a train from standstill is considerably below that which the engine is

apable of developing even at its idling speed, it is cus-
›mary and advantageous to make the initial power ap-
lication with the engine turning over at this speed. The
ontrol system, even then, must incorporate an automatic
mit to the power applied in order to provide for a
mooth start.

In this respect, the differential field control has
leal characteristics because the initial power demand
: low and because the engine is not required to develop
ıll torque until full engine speed is reached. The power
utput rises automatically as the engine speed rises (al-
hough much faster) until full load is reached at full
ngine speed. Autoload control embodies this same char-
cteristic, since the basic load regulation is that of the
ifferential field control system.

Figure 12 shows the power output characteristics of
ıutoload control as related to varying engine speed.
:urve *A-B-C* is the approximate load demand curve
›llowed by regular differential field control at normal
:mperature of electrical equipment. Under cold gener-
tor and exciter field temperatures, this curve might
ary toward the left, as shown by the dotted curve. If
he engine power curve is normal, the differential field
ontrol curve will load the engine fully at full engine
peed as shown at *C*. Under the cold electrical temper-
tures assumed, however, only 85 per cent power can be
›btained at 82 per cent of full engine speed, and the
ngine speed cannot rise above this until the electrical
emperature increases.

With Autoload control set to take a maximum of 115
er cent of full engine power at full engine speed, the

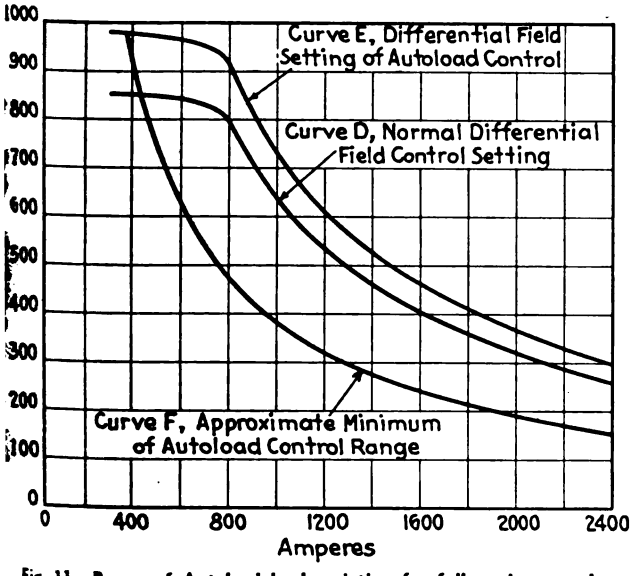


Fig. 11—Range of Autoload load variation for full engine speed

›utput is as shown by curve *AA-BB-CC*. It may be
›oted that, while the starting power is approximately the
ame as for simple differential field control, there is a
lefinite improvement in overall performance at all en-
›ine speeds.

If the engine gives its rated output, the Autoload per-
›rmance follows curve *AA-BB-CC* to point *BB*, where
he carbonstat becomes effective to limit the power to
ull load and the output then follows along the rated pow-
r curve from *BB* to *C*. With excess engine power the
›utput follows on up toward *CC*, instead of toward *C*.
With an engine in extremely poor condition (say 60 per
ent of rating), the output is from *AA* to *D* to *E*. Under
hese conditions, where the power is limited, Autoload
›ntrol has the inherent characteristic of loading the en-
gine to its available capacity at a lower engine speed than normal, which compensates to a slight degree for the falling off of engine power.

Under low electrical temperature conditions, Autoload control loads the engine in a manner similar to regular differential field control at all engine speeds up to the point where full engine torque (or full available output) is reached, such as point *F* on the rated engine output curve.

Above this speed, however, Autoload control limits the output to that available and thus allows the engine to rise to its normal speed, whereas simple differential field control would definitely hold the engine speed and available power to subnormal values.

The application of Autoload control to a Diesel-electric transmission system insures the most effective use of

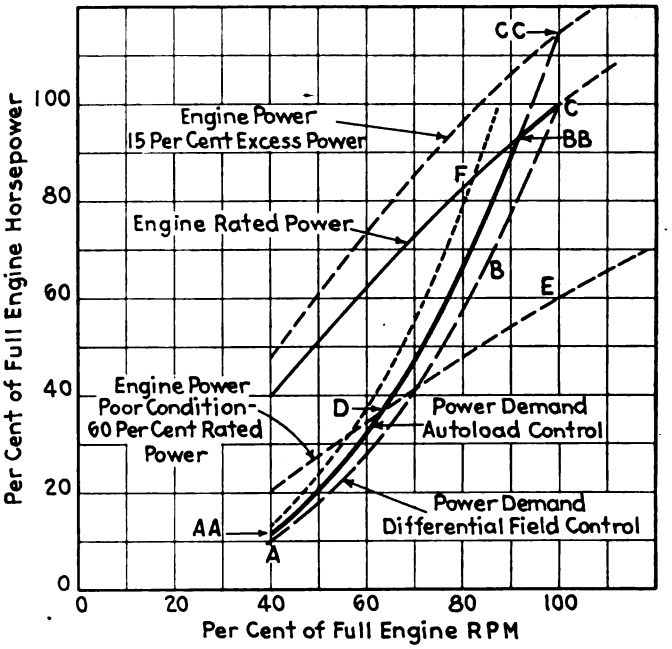


Fig. 12—Engine loading at various engine speeds—Values shown are approximate

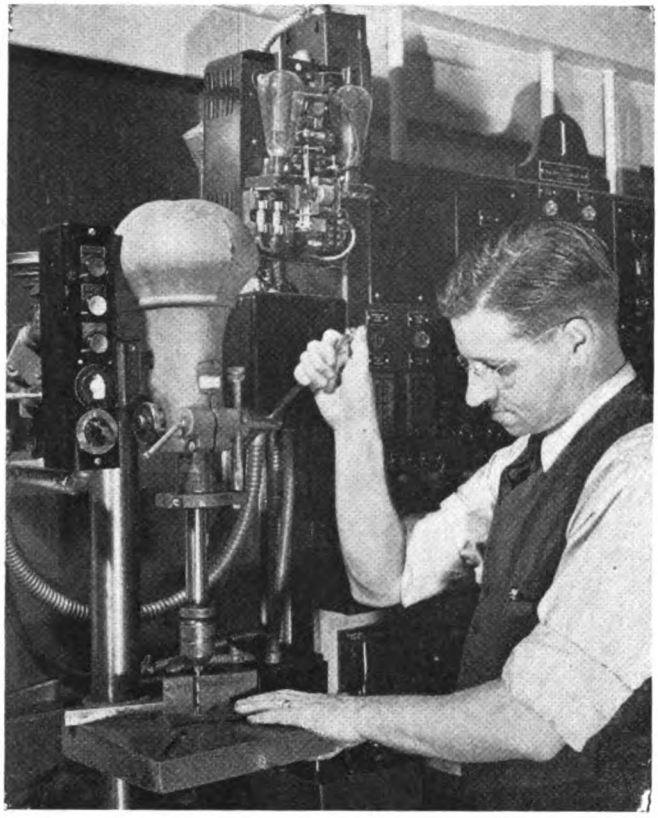
all of the available engine power under all operating conditions and results in considerably improved performance of the unit, whether in switching work or in road hauls. Since this is accomplished with minimum stress and abuse of the engine and with but a simple addition to a tried and proven control system now in daily commercial use, Autoload control is prescribed as the best known vitamin for Diesel-electric motive power.

From 25 To 1,750 R.P.M.

Electronic control of motors is now offering new potentialities in speed control. The application shown in the illustration is that of a ⅓-hp. Thy-mo-trol drive used on a small drill press in the Schenectady plant of the General Electric Company. A range of operating speeds from 25 r. p. m. to 1,750 r. p. m.—obtained simply by turning a small knob on a push-button station—enables this simple drill press to do jobs that would otherwise require a much more complicated machine or perhaps several machines.

Speeds available on the drill are so much slower than those obtainable without changing pulleys on similar

drills that it can be used on hard-to-drill materials, such as molded compounds, and for the fly cutting of large diameter disks. Since the drive permits reversing as well as independent adjustment of speed in each direction, tapping can be done at the proper preselected speeds for both tap and back-out.



The motor controls are shown at the left—the apparatus required may be seen back of and above the operator's hand

Several hundred Thy-mo-trol drives of larger size are now serving the war effort by providing precise, convenient control of machine tools and a variety of other equipments.

Turning The Table

(*Continued from page 380*)

anger. "Anyway, I'll do my best. How soon can you let us have the table for a couple of hours?"

"Oh, about 10:30, I'd say." The foreman turned and went into the roundhouse.

"What's the verdict?" Johnson came up and asked.

"Same old story. I still say locomotives should be built with a pilot at each end. If you will get that roll of number four wire we can cut wires to approximate lengths and solder lugs on one end while waiting for the table."

It was eleven o'clock before the table was released, then Evans said he would have to use it again by twelve-thirty.

"Wish I had joined the Seabees," Sparks said.

"Yeah, and maybe now you would be fighting Japs with one hand and stringing wire with the other," Johnson said. "Why can't we hang the new resistors at a different place from where the old ones are and run the wires up into the cab, then it won't take long to connect them up."

"We could," Sparks squinted his left eye, "make temporary connections to the new controller before we take the old one out. If we used long enough wires we could set it in place, then run the permanent wires in conduit."

"That's one way of making a big job out of a little one," Johnson said, "but it could be done."

The turntable was never out of service over two hours at a time while the new controller was being installed, but it took Sparks and Johnson two days and four hours overtime to do it. The division engineer raised Cain because the labor cost exceeded the allowance, but otherwise every one was well pleased.

"WELL, looks like we might have a little time to clean a few motors and do a little maintenance in the next few days," Sparks remarked when he came into the electric shop the morning after the turntable job was finished.

"Master mechanic wants to see you," John Harris stuck his head through the door and said to Sparks.

"They are still having trouble with the well motor at Sanford," the master mechanic told Sparks. "I thought you fixed it."

"I did put up heavier wire. The trouble must be something besides low voltage," Sparks said.

"Well, they ran out of water yesterday before any one noticed the motor was stopped. Better find what's causing the trouble and correct it."

That afternoon Sparks went to Sanford. He went directly to the roundhouse from the station. A voltage test showed 446 volts on the line which was plenty good. Using a split core meter, he tested to see how much current the 10-hp., 440-volt motor was using. The meter showed nearly thirteen amps which wasn't excessive. He went to a hotel and asked for a room. There wasn't any. He decided if he had to sit up all night he might as well work.

He again checked voltage and current. Both were the same as before. Then he didn't know what else to do. He sat down and lighted a cigarette. While he was sitting smoking and thinking, the night pumper who also handled fuel oil and water treating plant came up and started to open a valve.

"What are you going to do?" Sparks inquired with very little interest.

"Open the valve to the sump and close the valve to the storage tank," the pumper said. "The storage tank is nearly full."

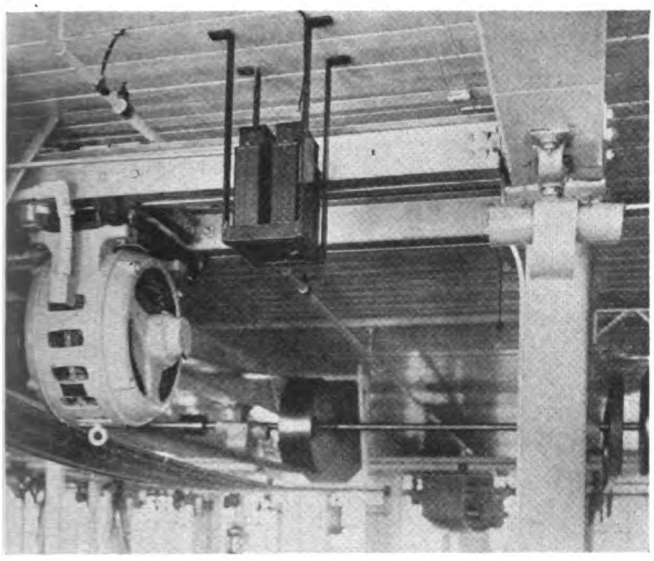
When the valves were changed, Sparks picked up his ammeter and tested the current. It had risen to almost sixteen amps. The overload relays were set to trip at fourteen and two-tenths.

"So that's the reason the motor stops," Sparks said.

"Why?" the pumper wanted to know. "The supply tank is lots higher than the sump."

"Yeah, that's why it's not overloaded pumping into the tank. Close the valve a few turns—turn it slow." Sparks watched the ammeter while the valve was being closed. The hand gradually fell back until it reached the same value as when pumping into the tank. "Now, if you don't open the valve any more than that when pumping into the sump, the motor won't stop."

Sparks found a caboose cushion and a soft place on the cement floor of the oil house and went to sleep.



Capacitors

How can I tell when a capacitor is not operating properly?

An Ammeter and a Voltmeter Will Tell the Story

A capacitor used for power-factor correction is simply a static condenser connected in shunt across the line. Modern capacitors consist of alternate layers of aluminum foil and insulating paper rolled into a compact form and immersed in either vegetable, mineral, or synthetic oil in a hermetically sealed metal container. Synthetic oils, such as Pyranol or Inerteen, are most used today. Usually several layers of paper are used between the aluminum sheets to prevent the superimposing of conducting spots which are unavoidable in commercial papers.

The kva. of a capacitor varies directly as the applied frequency, and its capacitance, and as the square of the applied voltage, and is expressed by the formula, kva. (reactive) $= EI = \frac{2\pi f C E^2}{1{,}000}$. To test a capacitor or bank of capacitors to see if they are operating properly it is only necessary to use a voltmeter and an ammeter, preferably one of the clip-on type. Take a reading of the voltage applied to the capacitor and the resulting current flowing through it.

For single-phase, or if testing just one phase of a three-phase installation, the current should be, $I = \frac{\text{kva.}}{1{,}000E}$ If measuring the line current of a three-phase installation the current should be, $I = \frac{\text{kva.}}{1{,}730E}$. (For all practical purposes on three-phase 230 volts figure 2.50 amp. per kva., and on 460 volts 1.25 amp. per kva., where the kva. is for the entire three-phase installation.) As can be seen from the formula the current varies as the square of the voltage, so if the voltage applied is not as rated on the capacitor, a correction is necessary. For example, if a capacitor is rated at 230 volts, and the voltmeter indicates an applied voltage of 260 volts, the ammeter should show a current flowing of $\frac{(260)^2}{230}$ or 28 per cent greater than rated normal current. (For best operation the average voltage over a 24-hour period applied to a bank of capacitors should not exceed the rated voltage by more than 5 per cent.

If the current flowing is greater than that which can be accounted for by the calculations above, there is the possibility of an excessive third harmonic present in the applied voltage. It might be well to check the supply system for unbalanced conditions, particularly for open-delta transformer banks which are often the source of third-harmonics. In no case should the kva. (1.73EI) be allowed to exceed 35 per cent the rating of the capacitors if damage is to be avoided.

Capacitors seldom develop open-circuits and of course if one exists no current will flow. Since banked capacitors are of necessity connected in parallel, a short-circuit occurring in any one of them will short-circuit the entire bank and blow the fuses. Capacitors should be protected by the nearest size fuses to 150 per cent of the proper current for their kva. rating. For 2,300-volt capacitors, manufacturers recommend using fuse links not larger than 75 amp. which limits the size of a bank to 180 kva. (The common size of single capacitors are 15 kva. single-phase units.) Two hundred and thirty and 460-volt banks on one set of fuses are usually kept down to 90 kva.

If the capacitors are to be tested with the power disconnected, care must be taken that they are discharged to a safe value before being handled. Modern capacitors are built with internal discharge resistors that should reduce the residual charge to 50 volts or less within five minutes. As as extra precaution a temporary short-circuit may be applied between terminals, and between terminals and the grounded case. A magneto should not be used for testing capacitors because on account of its alternating-current characteristics it will ring whether the capacitor is short-circuited or not. A constant-pressure Megger is the best instrument to use. With a short-circuit it will read zero, and on an open-circuit infinity. For a capacitor in normal condition it will give a steady reading somewhere between zero and infinity depending on the conductivity of the dielectric, which is never a perfect insulator.

ROLAND BERTI,
Union Pacific,
Omaha, Neb.

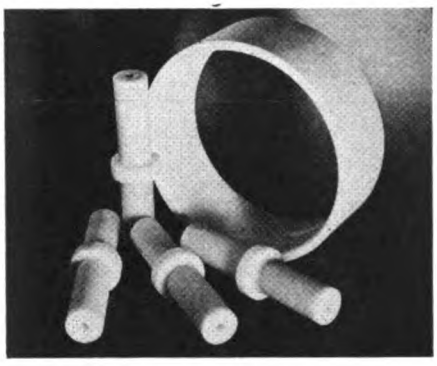
Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, Railway Mechanical Engineer, 30 Church Street, New York, N. Y.

A number of our a. c. and d. c. machines remained submerged for four days during a recent flood. What is the easiest way of restoring these machines to service?

NEW DEVICES

Insulator Glassware

A line of electrical insulation known as Multiform insulators is announced by the Corning Glass Works, Corning, N. Y. The multiform process involves a combination of cold-molding batch materials and subsequent fusing. This allows the making of glass insulators in a wide variety of shapes and sizes ranging from small insulating beads to large insulators weighing 25 lb. or more. Countersunk and tapped holes are practicable as are both external and internal threads and grooves. The insulators can be molded to small tolerances and can be ground and polished to closer tolerances if necessary.



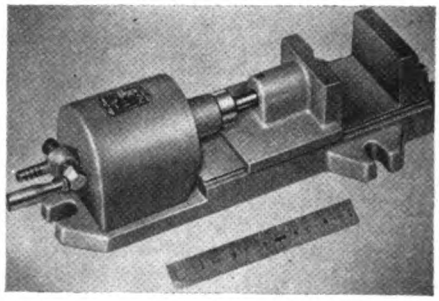
Examples of Multiform glass insulators

Mechanical and dielectric strengths are somewhat less than those for standard glass insulators. Water absorption is less than 0.01 per cent in 24 hrs. Impregnants or added glazes are unnecessary.

Air Vise

An air vise for clamping work pieces firmly in position for drilling or milling operations is being offered by the Mead Specialties Company, Chicago. Known as the Mead Air Vise, Model 42, the unit can be furnished with hand control or with one of two types of foot control. In one case pressure on a foot pedal releases the jaws, in the other pressure on the pedal closes the jaws while the pedal is down.

Two jaw settings are provided. The smaller takes work from 0 to 2 in., the larger from 1⅜ in to 3⅜ in. Still larger openings can be had by moving the air cylinder farther back on the base of the vise. The use of dove-tail ways for the sliding jaw provides smooth action, free from play in any direction. Long ways keep the jaws parallel, even where work is held off center, and prevent any binding action from absorbing part of the holding power. The sliding jaw cannot lift as it closes on a cylindrical piece held horizontally.

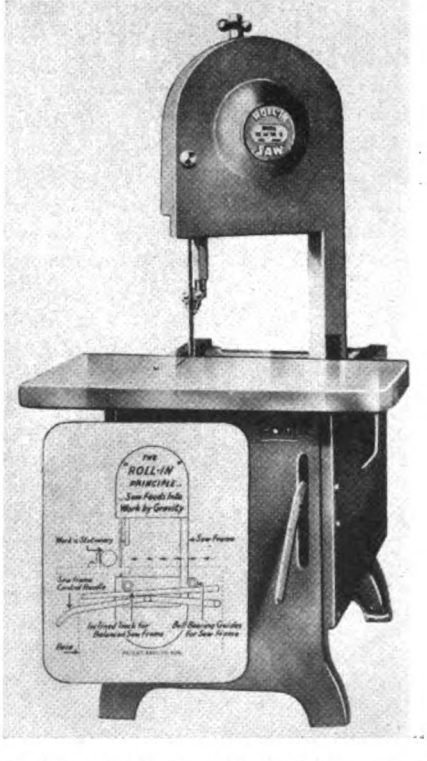


Work can be firmly held in this air vise for drilling or milling operations

The length of stroke can be controlled by means of an adjustable collar on the ram. The pressure factor is four times the line pressure.

Metal Cutting Bandsaw

The Universal Vise & Tool Company, Parma, Mich., have introduced a metal-cutting bandsaw operating on a gravity feed principle. The saw blade is fed into the work through the movement of a balanced blade wheel frame mounted on an inclined track. Blade pressure is automatically regulated by the texture and degree of hardness of the metal being cut. No attention from the operator is required. Blade breakage resulting from incorrect pressure is eliminated. The saw is adaptable for cut off, trim and contour work. A swivel block for holding work is readily removable for contour sawing or long straight cuts. Three speeds of 81, 161 and 264 ft. per min. are provided. The area of the work table is 18½ in. by 30 in. and the height from the floor 30 in. The saw cut is vertical and down with a maximum cut of 7 in. vertically. The blade travels 7 in. into the work piece. By resetting the work, any depth of cut can be made.



A roll-in principle is used to feed the saw blade into the work

Infra-Red Oven

An insulated-reflective infra-red heating and baking oven made in sections to permit its assembly in various forms is now being made by Infra-Red Engineers & Designers, Cleveland, Ohio. The oven may be used for drying paint, for baking or armatures and electrical coils, for making shrink fits, for drying metal parts, etc.



An oven section which includes a conveyor I-beam

Heat is developed by incandescent lamps with internal reflectors. The oven sections have reflective surfaces and are filled with Fiberglas for heat insulation.

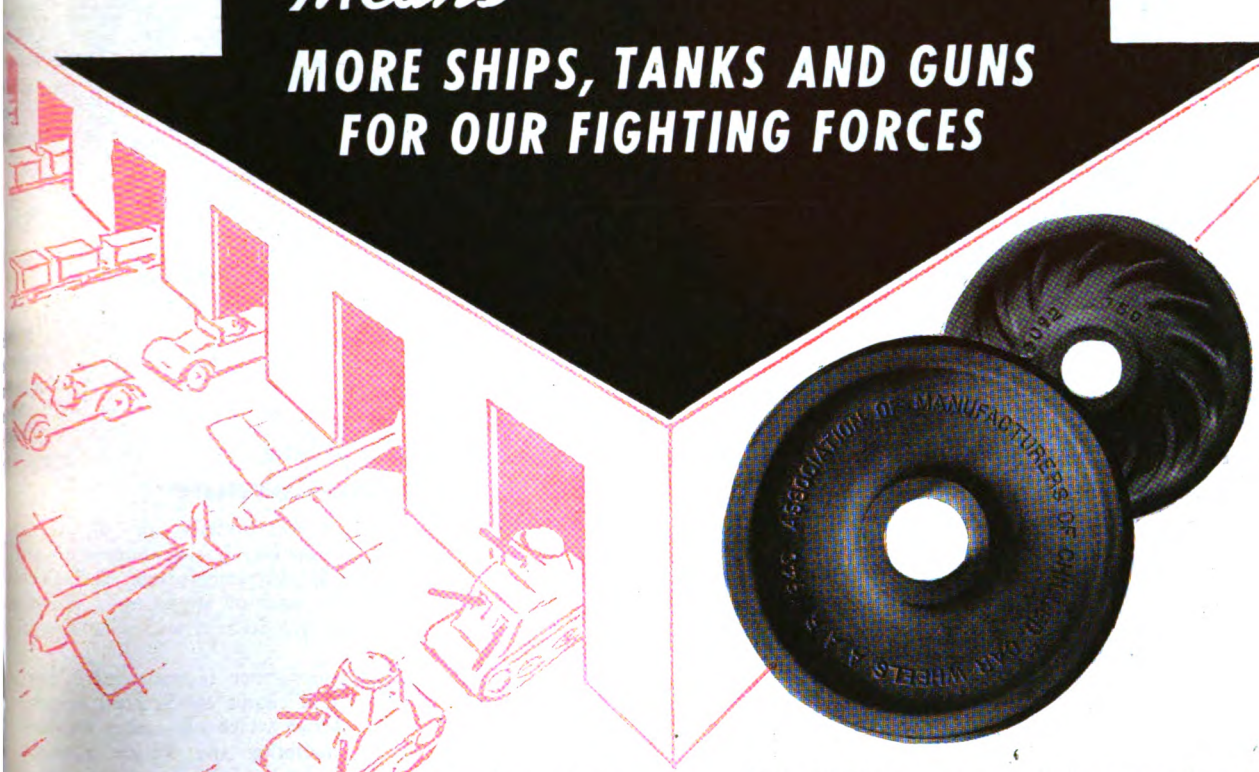
In addition to the primary air circulation upward within the oven proper, there is a secondary air circulation which meets the primary air in the fume duct where both join and go out the chimney together. Secondary air passes between the back of the reflective panel and the exterior covering of the oven.

(Turn to next left-hand page)

MORE METAL SAVED IN INDUSTRY

Means

MORE SHIPS, TANKS AND GUNS FOR OUR FIGHTING FORCES



Perhaps no other opportunity is offered the railroads to conserve as large an amount of metal as in the purchase of Chilled Car Wheels. The large saving of metal in the manufacture of Chilled Car Wheels is evidenced by the fact that in 1942 approximately 782,181 tons of the 885,020 tons of metal used in their production were scrapped wheels. This saving undoubtedly made possible the production of a very substantial amount of war materials.

Under our wheel exchange plan, by which the railroads receive new Chilled Car Wheels for old, on a conversion charge basis, the railroads send scrapped wheels to our 38 strategically located foundries in the United States and 8 in Canada, where they are speedily recast into new wheels.

Only 11.22 per cent new pig-iron went into the 885,020 tons of metal used in the manufacture of the 2,682,000 Chilled Car Wheels delivered to American and Canadian railroads in 1942. If the 782,181 tons of scrapped wheels used in making new Chilled Car Wheels had been *new* metal, our fighting forces might have had fewer ships, tanks and guns.

1942 CHILLED CAR WHEEL PRODUCTION:
2,682,000 Chilled Car Wheels were delivered in 1942.
885,020 Tons of metal were used to make them.
Of these:
782,181 Tons or 88.38% were scrapped wheels.
99,299 Tons or 11.22% were new pig-iron*.
3,540 Tons or .40% were alloys.
This *IS* Salvaging Scrap for the War Effort!
*Secured with the cooperation of W.P.B.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

3351

Voltage Tester

A voltage tester which is made up essentially of four neon lamps and a network of resistors is being offered by the Superior Instruments Company, New York. It indicates whether the voltage is 110, 220, 440 or 660, and whether the current is a.c. or d.c. The model 590 illustrated is 5 in. long, 1¾ in. wide, 1⅝ in. deep and weighs 5 oz. The front panel is steel, the box is wood and the instrument is provided with needle-pointed test prods for making the necessary contacts.



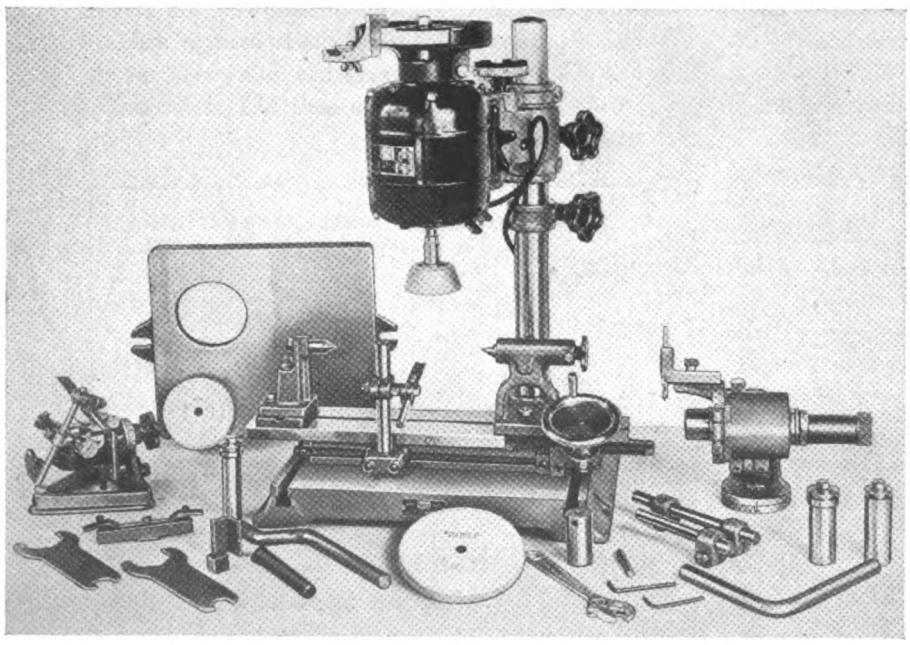
The model 590 voltage tester

Grinder for Tools and Cutters

A tool and cutter grinder equipped to handle the grinding of practically all types of milling cutters has been introduced by the Roan Manufacturing Company, 1225 Washington avenue, Racine, Wis. It is also used for contour grinding, and, being portable, it makes a useful bench grinder.

It includes features that are said to make for simplicity of operation, fast set-ups and high-speed precision grinding of assured accuracy. These features include a motor grinder head and bracket which can be raised, lowered and swiveled around, accurate vertical adjustment being assured by a vernier feed on the motor bracket. The motor itself can be swiveled to bring grinding wheels into any desired position.

Complete fixtures and accessories are provided to accommodate various types of tools. Among these is a precision slide which can be used independently of the grinder as a bench center for indicating and inspecting tools. There is also an outside diameter grinding fixture which is used for holding end mills and milling cutters, and special form tools which cannot be held on center. It is also employed in grinding the end of end mills, side cutting teeth of milling cutters and many other facing tools in a wide range of sizes. The unit has a base 18 in. by 16 in. and the column is 25 in. high. The weight, complete with all fixtures, is 175 lb.



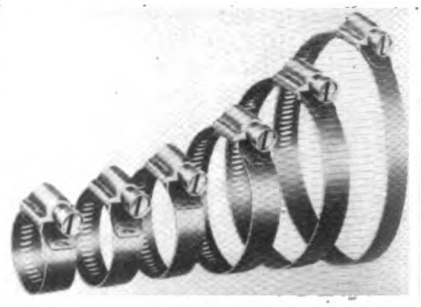
Grinder for milling cutters which can be adapted to many other tool-room needs

Hose Clamps

The Aircraft Standard Parts Company, 1711 Nineteenth avenue, Rockford, Ill., has recently introduced its line of Aero-Seal hose clamps in fourteen sizes from ¾ in. to 4 in. inside hose diameter.

The clamps consist of a 9/16-in. tempered steel band punched with holes corresponding to the teeth of a worm gear. These holes mesh with a worm in the housing welded to the fixed end of the band. The worm is turned by a screw driver, and the screw head on the worm is fitted with a safety cup which prevents the screw driver from slipping and puncturing the hose or damaging other equipment. Rapid action is obtained by a ten-pitch thread so that full take-up is obtained with only a few turns of the screw driver. The belt-like tightening action produces a uniform tangential pull which does not distort pipe and results in a leakless clamping action. By backing up the screw, the free end of the band comes out of the housing, and the clamp may then be sprung open and slipped over the hose in place on the pipe. Likewise, a clamp can be easily removed in the same manner. This operating convenience is obtained without loose pieces in the clamp unit.

The clamps are self-locking as a result of the worm and worm gear action and are virtually impossible to loosen even with severe vibration as long as the band is under tension. Lock wires are not necessary.



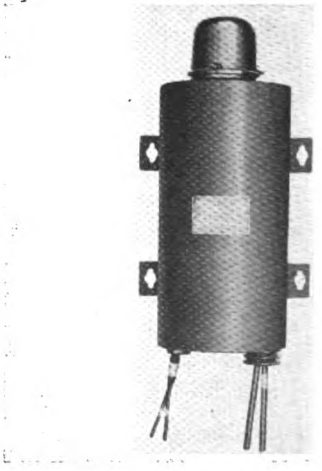
These clamps are drawn firm and tight by the use of a screw driver

Lighting Transformer

The Lighting Division of the General Electric Company has announced a series-multiple lighting transformer whch affords a simple means of operating a floodlight or searchlight from a series lighting circuit.

The transformer is constructed with a built-in film cutout open-circuit protective wiring device which eliminates the necessity of mounting and wiring a separate protective device. It is designed to operate a standard 115-volt multiple floodlight or searchlight.

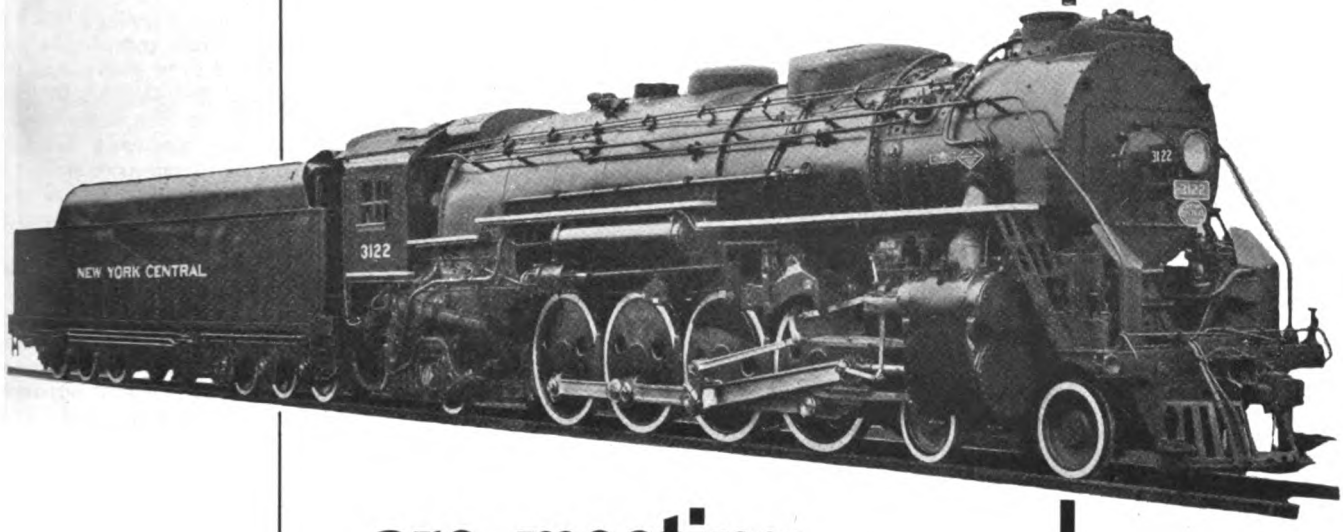
The use of the transformer is particularly advantageous at guard towers and other remote points, where the installation of a multiple circuit for the purpose would require extensive use of critical materials, and where a series lighting circuit is nearby.



G.E. series-multiple lighting transformer

(Turn to next left-hand page)

LIMA LOCOMOTIVES



are meeting the test of WAR

Locomotives are being worked longer and harder than ever in railroad history. Only in this way can the war-time burden of transportation be handled.

Railroad equipment of all kinds is undergoing a supreme test and out of this testing is coming confirmation of the soundness of Lima design and workmanship.

Lima power is standing up to its war-time job.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

High Spots in
Railway Affairs . . .

Those Grade Crossings

According to a report from the Grade Crossing Committee of the Association of Railway Claim Agents, the number of railroad grade crossings decreased from 235,827 in 1933 to 229,722 in 1941. The number of grade crossings not specially protected decreased from 205,199 to 196,863. While these decreases are gratifying they are far too small, as is indicated by the railroad grade crossing accidents last year. They numbered 4,150 and accounted for 4,616 injuries and 1,970 fatalities. This is not far from the average over recent years.

Human Element In Railroading

O. D. T. Director Eastman made a special trip to Cincinnati on July 14, to address a meeting of the leaders of the Railroad Y. M. C. A. He spoke highly of the zeal and enthusiasm with which railroad managements and employees have carried on during the emergency. He regards it as one of his first duties "to do nothing to impair their morale, but on the contrary, to do everything to sustain and promote it. * * * The purpose of the Railroad Y. M. C. A.'s, as I take it," he said, "is to promote the well-being of the railroad worker, both physical and spiritual, and they have been faithful and effective in accomplishing that purpose." At the very opening of his address he said: "We have not yet got to the point, and we never shall, where machines can function without the skillful aid and guidance of humans. Certainly there is nothing in the operation of our railroads which is of more importance, if the best results are to be secured, than the men and women who work for them, including not only the managers, but the entire body of employees. And I am also sure that the more these men and women have the inspiration which is born of religion, in its broader meaning, the better the work they will do."

Railroad Executive Drafted

The railroads have been operated so effectively in this World War that the government has not only not had to take them over, as the pessimists predicted, but it is drafting railroad executives for big and unusually difficult administrative assignments entirely outside the transportation field. Last September William M. Jeffers, president of the Union Pacific, was chosen by the War Production Board as the rubber administrator. In announcing this appointment, Donald M. Nelson, chairman of the W. P. B., emphasized that it was a tough job and that no chances could be taken in experimenting with a man about whose ability or performance there was any question. The improvement in synthetic rubber production has fully justified Mr. Nelson's choice. On June 28, the Secretary of the Interior, Harold L. Ickes, who is also acting as Solid Fuels Administrator for War, appointed Carl Elbridge Newton, president of the Chesapeake & Ohio, as director of mine operations for the federal government. In announcing the appointment Secretary Ickes said: "Mr. Newton's appointment as director of mine operations represents the selection of an individual with a vital public interest in and knowledge of coal, free of any partisan connection with either operators' or mine workers' organizations. He will be a full-time government worker whose services are loaned by his railroad as a contribution to the war effort. I am delighted to have been able to draft him for this unprecedented and extremely difficult task."

Women Railroad Workers

In the first quarter of this year, or between mid-January and mid-April, the number of women employed by Class I railroads increased about 30 per cent, or from 63,187 to 82,107. In the same period the total number of employees increased from 1,139,480 to 1,347,128; the percentage of women employed thus increased from 4.79 to 6.09. The number of women machinists increased from 4 to 29 and the number of women general laborers in shops, enginehouses and power plants increased from 2,629 to 4,504. These statistics are taken from the quarterly report of the Bureau of Transport Economics and Statistics of the Interstate Commerce Commission.

Oil for the East Coast

For the week ended July 10 the tank-car loadings of oil topped the one million barrel mark for the first time, with an average of 1,017,029 barrels a day. In addition to meeting the increased needs of the armed services, storage stocks in the eastern area are being built up to what might be considered a safe minimum. Meanwhile, on July 19, the final link was closed in "Big Inch," the world's biggest and longest oil pipe line. It extends from Longview, Texas, to Linden, N. J., a distance of 1,341 miles. Work on it was completed a little less than a year from the time it was started. It passes under 13 rivers, climbs eight mountain ranges, and tunnels under highways and railroads. At times the labor force reached 15,000; the project is said to have cost about $95,000,000.

Fourth of July Crush

Despite the pointed warnings of the O. D. T., both furlough and civilian passenger travel proved to be heavy over the weekend which included July 4. Director Eastman of the O. D. T., suggests that the Fourth of July experience has provided a convincing demonstration of the limitations of railroad passenger-carrying capacity. With military and essential civilian travel increasing, he said, it will take only a small amount of unnecessary travel in the weeks to come to produce conditions of overcrowding such as prevailed over July 4 and "I am sure that no patriotic American would deliberately do anything to interfere with the movement of essential passenger traffic."

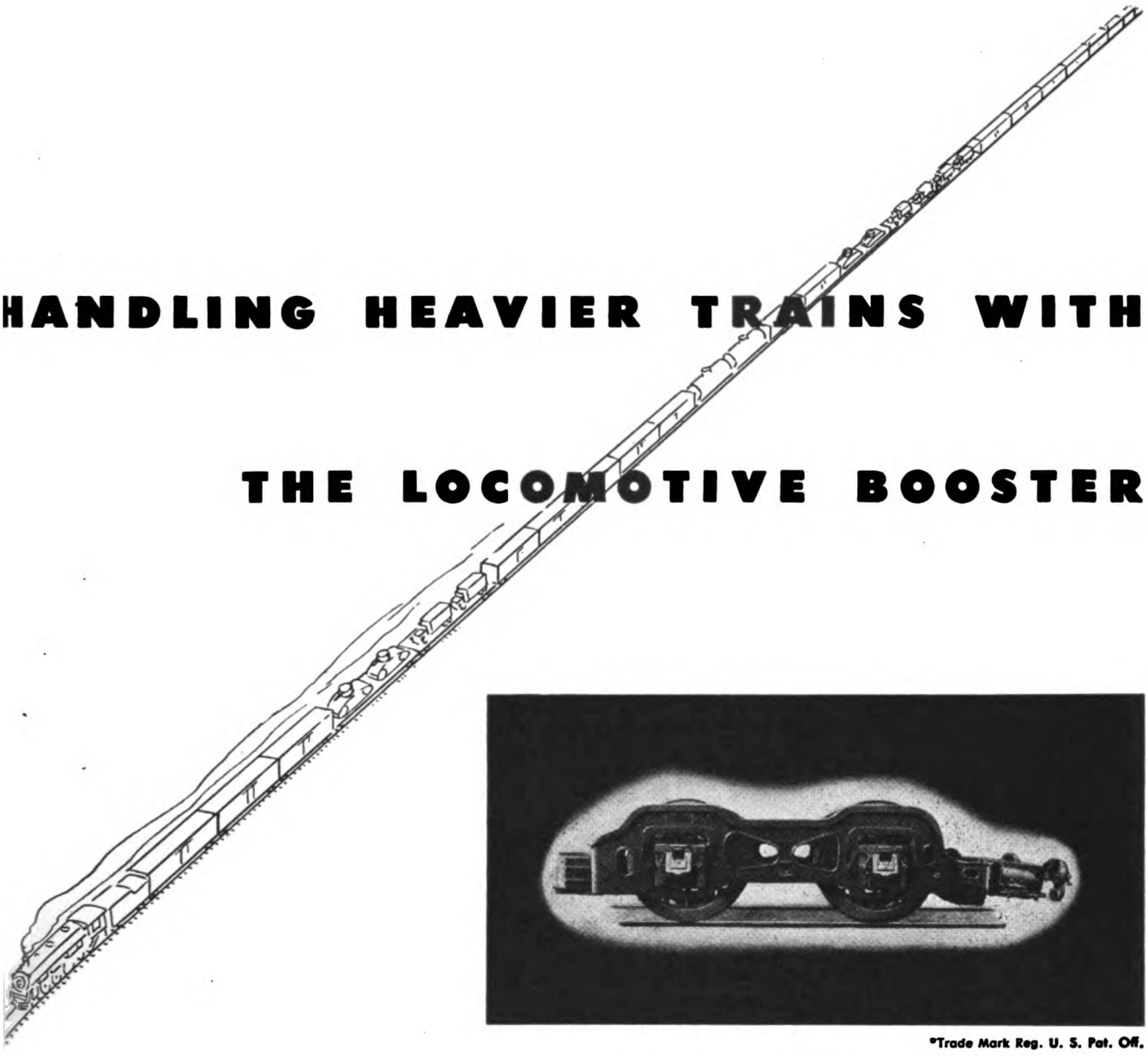
Railroad Safety Awards

Two agencies in this country are acting in stimulating efforts to prevent accidents and establish high standards of safety on our railroads. The National Safety Council grants awards each year to railroads in various groups, based on the number of man-hours worked, who make the best records in the prevention of casualties to employees. The American Museum of Safety sponsors the E. H. Harriman Memorial Medals Award for those railroads in three different categories as to size, that make the best record in accident prevention as a whole, including passengers, employees and other persons. The calculations are weighted, in order to take into account the relative importance of the different classes of accidents. The National Safety Council top awards for the year 1942 in the various groups, include the Union Pacific, 50 million man-hours or more; Michigan Central, 20 to 50 million man-hours; Duluth, Missabe & Iron Range, 8 to 20 million man-hours; Bessemer & Lake Erie, three to eight million man-hours; Lake Superior & Ishpeming, one to three million man-hours; and Nevada Northern, less than one million man-hours. The top award to the larger Class I switching and terminal railroads (1,500,000 man-hours, or more) went to the Conemaugh & Black Lick, and the award to the smaller roads in this group went to the Birmingham Southern. The E. H. Harriman Memorial Medals were awarded to the Chesapeake & Ohio among the larger railroads; the Bessemer & Lake Erie in the second class, and the Lake Superior & Ishpeming for the smaller roads. Judge R. V. Fletcher, vice-president, A. A. R., on the occasion of the Harriman Memorial Medals Award, directed attention to the fact that in 1942 the fatalities among employees were 1.47 for each billion ton-miles. This, he said, was a better record than the railroads have made in the last 26 years.

(*Turn to next left-hand page*)

HANDLING HEAVIER TRAINS WITH

THE LOCOMOTIVE BOOSTER



*Trade Mark Reg. U. S. Pat. Off.

As trains have lengthened with the rush of wartime traffic, the problem of starting the heavier loads has become more difficult. » » » Booster-equipped locomotives have the added power for use in starting and in accelerating that is of exceptional value under today's operating conditions. » » » On thousands of locomotives, the Locomotive Booster* is making it possible to handle extra tonnage and meet exacting schedules.

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NEWS

WPB Authorizes Construction of 5,000 Box Cars

THE War Production Board has authorized the construction of 5,000 box cars in the latter part of this year and the early months of 1944 and may allot sufficient materials for the construction of 6,000 more, according to R. E. Clark, manager of the Closed Car section of the Association of American Railroads, in an address before the quarterly meeting of the Midwest Shippers Advisory Board at Chicago on July 8.

The board's campaign to get more freight cars and other equipment for the railroads was supported by a message from Joseph B. Eastman, director of the Office of Defense Transportation, which reiterated his previous statements that serious consequences may result if the ODT's requests for materials and equipment for the railroads are not met by the War Production Board. He added that the ODT will continue to press vigorously for more equipment, not only for the railroads but for the other forms of transportation.

How serious the car situation may become was indicated by W. F. Kirk, chairman of the Advisory Committee on Traffic Control of the Western Association of Railway Executives, who predicted that the war in the next year will cause increases in westbound freight traffic ranging from 7 to 50 per cent. He said that traffic volume in April on some Western railroads equalled the high for October, 1942, and that since April the volume has increased further. The volume in the week ended July 2, he continued, exceeded any movement to date since the war began. Terminal movements have increased as much as 40 per cent, he said, with that through Los Angeles, Calif., on July 2 exceeding anything thus far.

"I am not critical of WPB," Mr. Kirk stated, "but I think we should recognize two things. First, the time has come when our boys should have the goods to finish this job and second, transportation agencies must have the equipment to get the goods to the boys."

Plan to Double Locomotive Construction in 1944

A RECENT meeting in Washington, D. C., of the War Production Board Advisory Committee of the locomotive building industry brought out the fact that the 1944 construction program calls for doubling the "record-breaking" 1943 locomotive output.

Assurances were given the WPB representatives at the meeting that the industry not only would meet the "tremendous" program outlined for the rest of this year, but also would accomplish the increase in output asked of it for 1944—provided production of vital components keeps up with its requirements. This will be accomplished, the WPB hopes, through the controls over production scheduling embraced in Limitation Order L-97-d, which was made effective July 1 to insure completion of the 1944 locomotive building program and because the components are needed for repair parts, for the modernization and conversion of existing equipment and for export. Under the order WPB may direct the return or cancellation of orders for 54 critical component parts on the books of manufacturers, allocate orders as between manufacturers and direct changes in production and delivery schedules.

WPB and War Department representatives commended the locomotive builders for their co-operation in accomplishing a 200 per cent increase in production since Pearl Harbor. The Army program for the first half of 1943 was met in full, it was explained, and 92 per cent of the domestic railroad program was completed. The failure to meet fully the domestic quota was due not to the builders, it was pointed out by the WPB, but to delays they experienced in procuring vital components.

At the advisory board meeting the entire 1944 War Department program and all steam locomotives that have been ordered by domestic railroads were scheduled for production. It was pointed out that locomotive orders placed by domestic railroads after July 15 will have to be scheduled for production in the second half of 1944, due to the length of time required to order and procure materials.

Revised Status of Car and Locomotive Orders

RAILROAD orders for new freight cars for domestic service during the first six months of 1943 totaled 15,051 units, of which 11,750 were placed with contract car builders and 3,301 with railroad shops. Purchased from contract shops were 770 box, 8,650 hopper, 1,340 gondola and 990 flat cars. Orders from railroad shops included 1,000 hopper, 2,000 gondola and 301 flat cars.

Following the virtual cessation of new freight-car purchasing during the final six months of 1942, due to limited government-authorized building programs, the railroads re-entered the market in January in large volume ordering 10,385 cars. Deliveries during that month from railroad and contract shops, however, barely topped 2,000 cars and each month thereafter failed to reach that number. New orders quickly dwindled to 980 cars in February, 1,936 in March, 1,200 in April, 500 in May and 50 in June.

In addition to the 15,051 cars ordered by the railroads, industrial companies and private car lines placed orders for 353 cars for domestic service during the first six months of the year, comprising 107 gondola, 25 hopper, 17 flat, 200 tank and four dump cars and there were 439 cars ordered in the United States for export, exclusive of War Department orders, including 210 box, 38 tank, 16 dump and 175 ore cars. (Reports of the number of cars ordered or built for U. S. Government Departments either for domestic service or for export are not permitted.)

The total backlog of cars on order for domestic service at July 1, 1943, amounted to 36,142 units. Included in this number were 65 cars remaining to be delivered under the War Production Board's 18,000-car program for the final eight months of 1942 and 16,361 cars representing the undelivered balance of the 20,000 cars authorized by the WPB in November, 1942, for building during the six months ended June 30, 1943. In addition there were 19,716 cars without WPB approval to build. The 36,142 cars on order were allocated; 26,783 to contract car builders, including 1,700 auto, 4,324 box, 4,490 gondola, 13,526 hopper, 1,671 ore, 875 flat, 172 tank and 25 caboose cars, and 9,359 to railroad shops including 100 auto, 750 box, 3,000 gondola, 3,558 hopper, 401 flat, 200 stock, 1,200 refrigerator and 150 caboose cars.

As of July 1, only 3,639 or 18 per cent of the 20,000 cars authorized for production during the first six months of the year by the War Production Board had been built. Of the remaining 16,361, 13,002 were on order with contract car builders, including 3,331 gondola, 7,319 hopper, 1,671 ore, 535 flat and 146 tank cars, and 3,359 with railroad shops including 1,900 gon-

(Continued on next left-hand page)

Orders and Inquiries for New Equipment Placed Since the Closing of the July Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Norfolk & Western	10[1]	2-6-6-4	Co. shops
Wheeling & Lake Erie	6[2]	Steam switch	American Loco. Co.
Erie	6[2]	5,400-hp. Diesel elec.	Electro-Motive Corp.

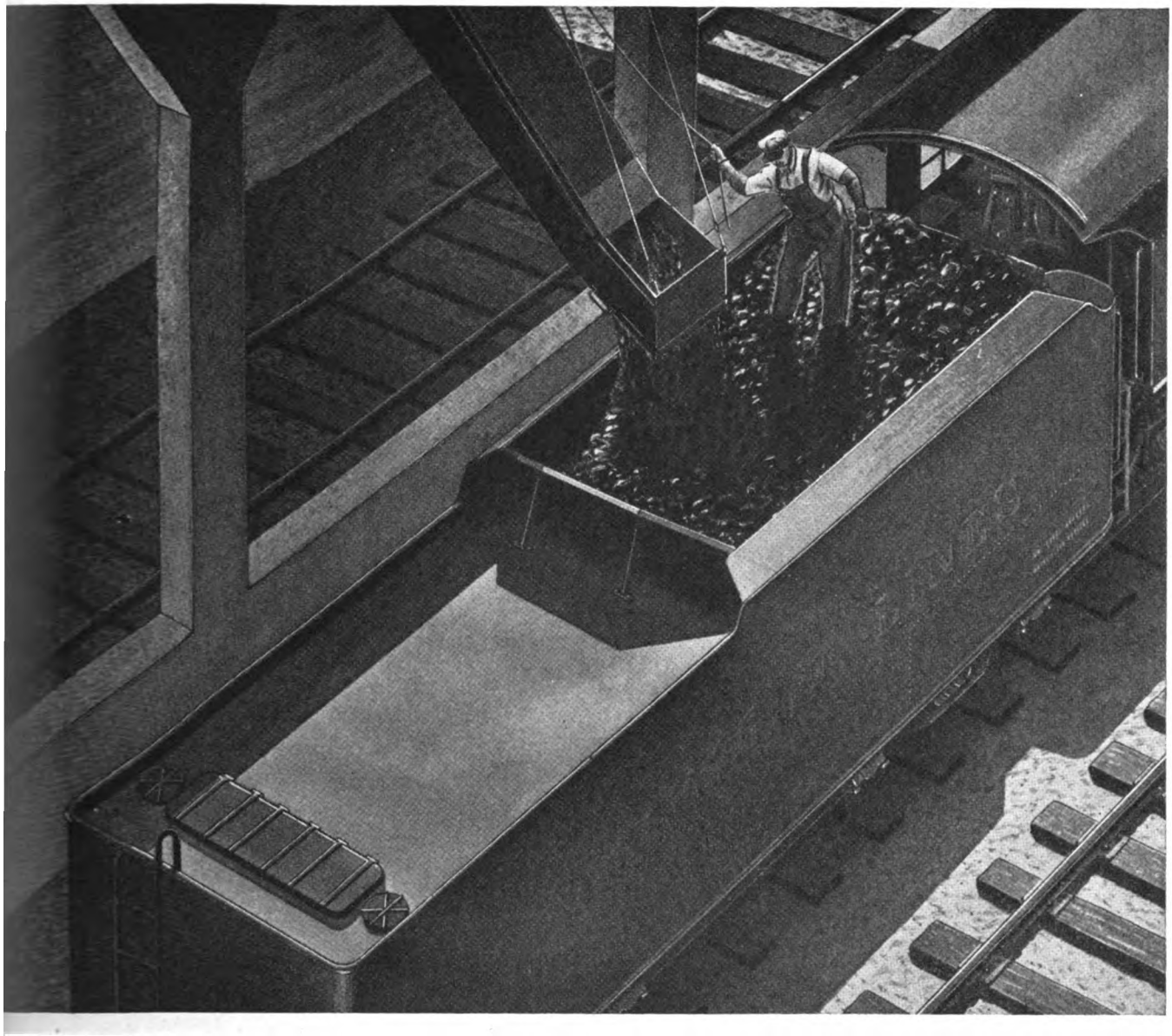
FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Alton	500	50-ton comp. hopper	Amer. Car & Fdry Co

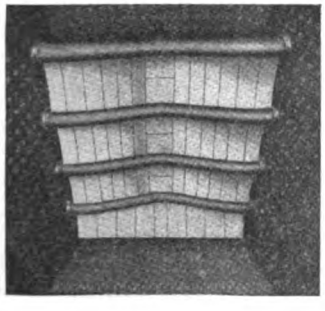
[1] These are in addition to 15 locomotives of the same type ordered in April, 1942, deliveries of which are now under way and are scheduled to be completed in September. Deliveries of the additional 10 engines are reported to be scheduled for the first six months of 1944.

[2] Subject to approval of WPB.

[3] Approximate cost of each locomotive $465,000. Reported for freight service between Marion, Ohio and Meadville, Pa.



Get Maximum Work from Each Pound of Coal



Every pound of coal involves scarce man-hours for its production and vital transportation to the point of use. Its economical use is essential.

For over 30 years the fuel savings of the Security Sectional Arch have been universally recognized by railroad men.

But only a complete arch can give the maximum in fuel economy. To this end see that every locomotive leaving the roundhouse has a full length arch.

HARBISON-WALKER REFRACTORIES CO.
Refractory Specialists

AMERICAN ARCH COMPANY, INC.
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Locomotive Combustion Specialists

Railroad Steam Locomotive Building Program at July 1, 1943

(Covers Locomotives Authorized for Production by the War Production Board)

Railroad	Type	Number ordered	Approximate deliveries To July 1	Reported delivery schedule	Builder
Atchison, Topeka & Santa Fe	4-8-4	30	..	Aug.-Dec.'43	Baldwin
	2-10-4	20	..	Feb.-Mar.'44	Baldwin
Baltimore & Ohio	2-8-8-4	20	..	Dec.'43-Feb.'44	Baldwin
Bessemer & Lake Erie	2-10-4	10	..	Sept.-Oct.'43	Baldwin
Central of Georgia	4-8-4	8	..	July-Aug.'43	Lima
Chesapeake & Ohio	2-8-4	40	..	Oct.'43-Jan.'44	American
	2-6-6-6	10	..	Apr.-June '44	Lima
	0-8-0	5	..	August '43	Lima
	0-8-0	5	..	December '43	Lima
Chicago, Rock Island & Pacific	4-8-4	10	..	Feb.-Mar.'44	American
Detroit, Toledo & Ironton	2-8-2	4	..	March '44	Lima
Indianapolis Union	0-8-0	3	..	January '44	Baldwin
Lehigh & Hudson River	4-8-2	3	..	February '44	Baldwin
Lehigh Valley	4-8-4	10	..	October '43	American
Missouri Pacific	4-8-4	15	2	July-Aug.'43	Baldwin
Nashville, Chattanooga & St. Louis	4-8-4	10	..	September '43	American
New York Central	4-8-2	25	..	Aug.-Nov.'43	Lima
New York, Chicago & St. Louis	2-8-4	15	..	Dec.'43-Jan.'44	Lima
Norfolk & Western	2-6-6-4	15	10	July-Sept.'43	Co. shops
	4-8-4	6	..	Oct.-Dec.'43	Co. shops
	2-6-6-4	10	..	Feb.-June '44	Co. shops
Pennsylvania	2-10-4	110	60	July-Nov.'43	Co. shops
	2-10-4	40	..	Feb.-June '44	Co. shops
Pere Marquette	2-8-4	12	..	Feb.-Mar.'44	Lima
Pittsburgh & Lake Erie	0-8-0	25	..	Feb.-Apr.'44	American
St. Louis-San Francisco	4-8-4	10	..	July-Aug.'43	Baldwin
Southern Pacific	4-8-8-2	20	..	Sept.-Dec.'43	Baldwin
	4-8-4	10	4	July-Aug.'43	Lima
Union	0-6-0	10	..	January '44	American
Union Pacific	4-6-6-4	25	4	July-Sept.'43	American

dola, 1,058 hopper and 401 flat cars. Evidencing this serious lag in freight-car production due to the continued shortage of materials, in all 24 railroads and eight private car lines on July 1 were awaiting deliveries of these 16,361 cars originally scheduled for production during the first six months of 1943 in accordance with government authorizations.

The 19,716 cars without WPB authority to build at July 1 comprised 13,716 on car builders' books, including 1,700 auto, 4,324 box, 1,120 gondola, 6,207 hopper, 340 flat and 25 caboose cars and 6,000 ordered from company shops, including 100 auto, 750 box, 1,100 gondola, 2,500 hopper, 200 stock, 1,200 refrigerator and 150 caboose cars.

The accompanying table shows as of July 1, 1943, a detailed list of locomotives scheduled to be built during the twelve months July, 1943-June, 1944, for delivery to domestic railroads in accordance with War Production Board authorizations.

The individual orders shown for these locomotives and WPB authorizations to build have been previously reported in the table of "Orders and Inquiries for New Equipment" which appears each month in these columns, and most of the orders were grouped in a table showing the month ordered in the April issue of the *Railway Mechanical Engineer*, page 116.

Included in the list are 536 locomotives, designed chiefly for freight service, of which 80 were delivered prior to July 1. Of the remaining 456, railroad shops will build 111 and the three contract builders 345.

Certain of the orders listed were placed in part in 1942 and increased in size early this year when the WPB approved the building of a larger number of locomotives for these partciular carriers than were already on order.

In addition to the steam locomotives listed in the accompanying table, there were on July 1 approximately 450 Diesel-electric locomotives authorized and scheduled for production during the subsequent nine months July, 1943-March, 1944. Of these about 85 were freight engines of 5,400-hp. each, ten of 2,000-hp. and the balance road and switching engines of 1,000 or 660 hp. The Diesel engines reportedly will be turned out at the rate of between 45 and 55 per month.

The Locomotive Institute Research Study

For some years The Locomotive Institute has been carrying on intensive studies in connection with steam locomotive design and performance through a committee of their technical representatives. Many subjects have been handled and methods adopted, all with the object of improving performance, reducing maintenance costs, and providing greater reliability and efficiency of the locomotive. Positive and advantageous results have accrued from these activities.

The necessary contribution to the war effort of all the locomotive builders has, to a certain extent, limited the time available to their technical staffs for steady prosecution of these studies. The Institute, with a full realization of the importance of continuous stress on war work, is also fully aware of the contribution being made daily by the railroads of the country in the handling of war materials, troops and supplies, no small part of which was due to their locomotive inventory. With this in mind and looking ahead to post-war transportation, it was decided that for the steam locomotive to maintain its position as the main reliance of railroad transportation throughout the world, these studies, already started, must be carried on without loss of time, and they have recently set up an organization to handle the work.

Lawford H. Fry was appointed director of research of The Locomotive Institute on July 1. His entire time will be devoted to research work in connection with locomotive design, under the jurisdiction of the Technical Committee of the Institute. Studies already under way in connection with motive power will be accelerated and a thorough investigation made of recent accomplishments that have already resulte in improving the performance of the stea locomotive to a point where yearly mileag more than double what they were a fe years ago.

Mr. Fry's background is such as to mak him eminently qualified for the work he undertaking. Many years experience in th engineering and testing departments of Th Baldwin Locomotive Works at Philade phia, metallurgical and engineering exp rience with the Standard Steel Work and the Edgewater Steel Company, as we as several years experience abroad wi stand him in good stead. He will be a sisted in his work by the technical exper of the locomotive builders. His headqua ters will be at 60 East 42nd street, Ne York, where offices and engineering faci ities will be maintained.

Diesel-Electric Switcher Standardization

Standardization of Diesel-electri switching locomotives is here to stay, a cording to a statement made by G. W. Wi son, manager, transportation departmen General Electric Company, in which h says: "It offers the ultimate user to much in terms of proved performanc quick delivery, low price and simplifie maintenance for him to revert to the pre war practice of a special design for ever occasion. Locomotive manufacturers wil revise the standard designs periodically t incorporate the latest developments—ma even have locomotive shows to introduc their new models." He estimates tha standardization of G-E switching locomo tives and carefully planned productio added more than 185 locomotive years o switching to the war effort in 1942.

According to Mr. Wilson, through th use of the standard locomotive, the tim consumed in design work, engineering an drafting before material can be ordere and the shop started on a "tailor-made locomotive can easily be cut in half. More over, this vital gain in time sacrifice nothing in performance and releases val uable skilled man-hours for other wa work, to say nothing of simplified main tenance. The standard locomotive has al ready proved itself in hundreds of instal lations, and it is simply a matter of order ing the proper size to do the job.

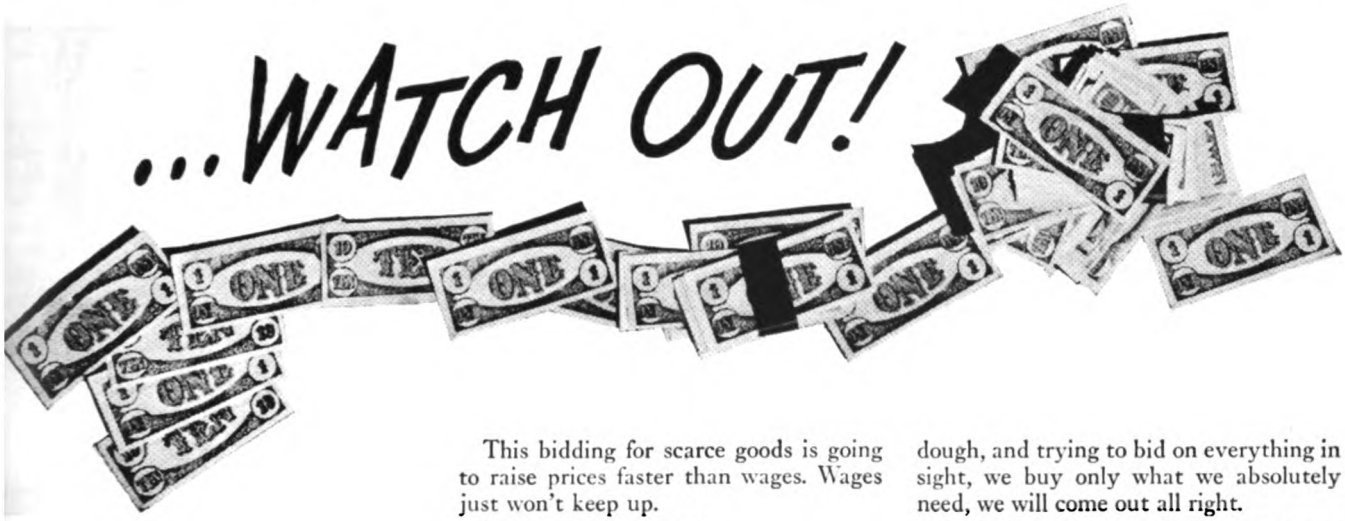
Many operators badly in need of switch ers, who formerly ordered specials, too standard units because of the quick deliv ery. They were so pleased with the per formance that they henceforth ordere standard units.

Car Supply via the Repair Rout

Indications that the railroads hav about reached the limit of what they ca do in the way of making more serviceabl cars via the repair route were seen in re ports discussed at the June 25 meeting o the Association of American Railroads board of directors in Washington. As o June 1, the number of serviceable car totaled 1,691,750, a decrease of 3,750 belo the previous month; and the bad order percentage was down to 2.8 per cent.

(*Continued on second left-hand page*)

IF YOU'RE MAKING MORE MONEY



WE WANT TO WARN YOU, before you read this page, that you've got to use your head to understand it.

We also want to warn you that—if you don't bother to read it carefully enough to understand it—you may wake up after this war as poor as a church mouse.

• • •

This year Americans are going to make —minus taxes—125 billion dollars.



But this year, we civilians are not going to have 125 billion dollars' worth of goods to spend this on. We're only going to have 80 billion dollars' worth. The rest of our goods are being used to fight the war.

That leaves 45 billion dollars' worth of money burning in our jeans.

Well, we can do 2 things with this 45 billion dollars. One will make us all poor after the war. The other way will make us decently prosperous.

This way the 45 billion dollars will make us poor

If each of us should take his share of this 45 billion dollars (which averages approximately $330 per person) and hustle out to buy all he could with it—what would happen is what happens at an auction where every farmer there wants a horse that's up for sale.

If we tried to buy all we wanted, we would bid the prices of things up and up and up. Instead of paying $10 for a dress we're going to pay $15. Instead of $5 for a pair of shoes we're going to pay $8.

This bidding for scarce goods is going to raise prices faster than wages. Wages just won't keep up.

So what will people do?

U. S. workers will ask for more money. Since labor is scarce, a lot of them will get it. Then farmers and business men who



feel the pinch are going to ask more money for their goods.

And prices will go *still higher*. And the majority of us will be in that same old spot again—only worse.

This is what is known as Inflation.

Our government is doing a lot of things to keep prices down . . . rationing the scarcest goods, putting ceiling prices on things, stabilizing wages, increasing taxes.



But the government can't do the *whole job*. So let's see what *we* can do about it.

This way the 45 billion dollars will make us prosperous

If, instead of running out with our extra dough, and trying to bid on everything in sight, we buy only what we absolutely need, we will come out all right.

If, for instance, we put this money into (1) Taxes; (2) War Bonds; (3) Paying off old debts; (4) Life Insurance; and (5) The Bank, we don't bid up the prices of goods at all. And if besides doing this we (6) refuse to pay more than the ceiling prices; and (7) ask no more for what we have to sell—no more in wages, no more for goods—*prices stay where they are now.*

And we pile up a bank account. We have our family protected in case we die. We have War Bonds that'll make the down payment on a new house after the war, or help us retire some day. And we don't have taxes after the war that practically strangle us.



Maybe, doing this sounds as if it isn't fun. But being shot at up at the front isn't fun, either. You have a duty to those soldiers as well as to yourself. You *can't* let the money that's burning a hole in your pocket start setting the country on fire.

★ ★ ★

This advertisement, prepared by the War Advertising Council, is contributed by this Magazine in co-operation with the Magazine Publishers of America.

KEEP PRICES DOWN!

Use it up
Wear it out
Make it do
Or do without

GM DIESEL LOCOMOTIVE

REQUIRES ONLY SIMPLE MAINTENANCE



SOUTHERN RAILWAY
DIESEL MAINTENANCE SHOP
LUDLOW, KY.







GENERAL MOTORS
LOCOMOTIVES

DESIGN FACILITIES...

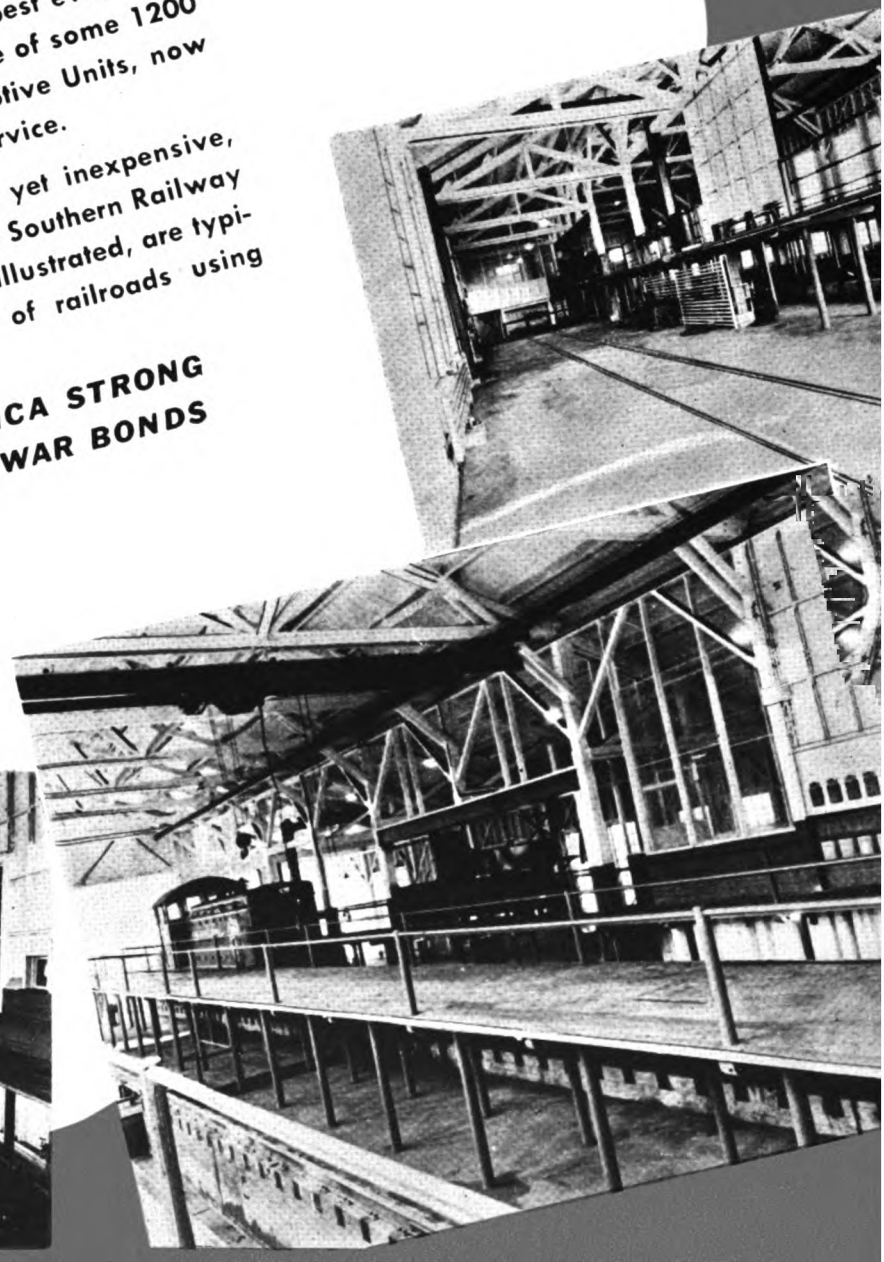
THE philosophy back of Electro-Motive basic design was, and still is, simplicity of construction, ease of operation and maintenance, interchangeability of standardized parts completely finished and ready for application.

The success of this thinking is best evidenced by the outstanding performance of some 1200 General Motors Diesel Locomotive Units, now operating in all classes of service.

The adequate and efficient, yet inexpensive, maintenance facilities of the Southern Railway at Ludlow, Kentucky, here illustrated, are typical of the present trend of railroads using GM Diesel Locomotives.

KEEP AMERICA STRONG
BUY MORE WAR BONDS





ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION LA GRANGE, ILLINOIS, U.S.A.

Thus it was suggested that the time is fast approaching, if it is not already here, when the railroads must have more new cars if they are going to "hold the line" on the supply of serviceable. The car supply situation was among subjects discussed at the meeting, where there was consideration also of the motive power situation.

720th Railway Operating Battalion Activated

THE 720th Railway Operating Battalion, sponsored by the Chicago and North Western, was activated on July 6, when 20 officers from the railway's personnel left for training camp. Enlisted men will be assigned to the battalion during the training period.

Heading the 720th Battalion is Lt. Col. C. J. Freeman, the commanding officer or "division superintendent", formerly right of way agent of the North Western's land department. Capt. C. B. Coyle, mechanic on the Wisconsin division, will command Company B as "master mechanic." First Lt. V. L. Duncan, relief roundhouse foreman at Chadron will be "enginehouse foreman."

The task of "general car foreman" is taken over by First Lt. Walter S. Ryall, car foreman at California Avenue. Second Lt. J. H. Larsen, engineer, Chicago freight terminals, will be "assistant to master mechanic." Commanding Company C, or the Transportation Company, is Capt. D. J. McLaughlin, yardmaster at Proviso. First Lts. C. S. Smith and Stewart St. John, Wisconsin division locomotive engineers, will be "road foremen of engines."

Allied Railway Supply Association Officers

THE executive committee of the Allied Railway Supply Association, Inc., in accord with the by-laws and constitution, have unanimously elected the following officers of the association: President and treasurer, C. F. Weil, American Brake Shoe & Foundry Company; first vice-president, M. K. Tate, Lima Locomotive Works; second vice-president, E. H. Weaver, Westinghouse Air Brake Company; third vice-president, B. S. Johnson, W. H. Miner, Inc.; and fourth vice-president, J. J. Cizek, the Leslie Company. This election was necessary because of the death of J. W. Fogg, who was president, and of F. W. Venton, treasurer.

Russia Here for "Enormous" Locomotive Order

THE Russians are in this country for an "enormous order" for locomotives, Major General C. P. Gross, chief of the Army's Transportation Corps, recently told a House appropriations subcommittee which was considering the Military Establishment Appropriation Bill for the fiscal year ending June 30, 1944.

General Gross did not say how many locomotives are involved in the Russian request, but he did reveal that this country has sent "quite a little" rolling stock to the Middle East. He went on to say that the shipping route to the Persian Gulf, and up to the Russian front there is being "highly developed"; and "approximately $35,000,000 worth of rolling stock has either been shipped from American ports to the Near East, or is in part being held at the ports ready for shipment."

"This rolling stock," General Gross added, "has gone to many different places and is now being utilized to make up the shortage that was apparent in several locations." He also revealed that the United States "sent some hundred locomotives to Africa prior to the fall of Tunisia." Speaking briefly about Brigadier General Carl R. Gray's Military Railway Service on the African front, General Gross called the outfit "a nicely balanced unit" of "some 6,000" railway troops.

Railroads Need Better Break Says General Gross

MAJOR GENERAL C. P. GROSS, chief of the Army Transportation Corps, in recently released testimony given before a House appropriations subcommittee which considered the Military Establishment Appropriation Bill for the fiscal year 1944, said that he does not think that the carriers have thus far "been given as favorable a break as they should have" by the allocation authorities at the War Production Board, "particularly in connection with locomotives." This statement was in response to a question asked by Representative Starnes of Alabama if in his opinion WPB "should give more sympathetic consideration to any application for priorities from the railroad systems of the country for replacement, repair, or maintenance of the railroads in order to make sure that an effective job is being done."

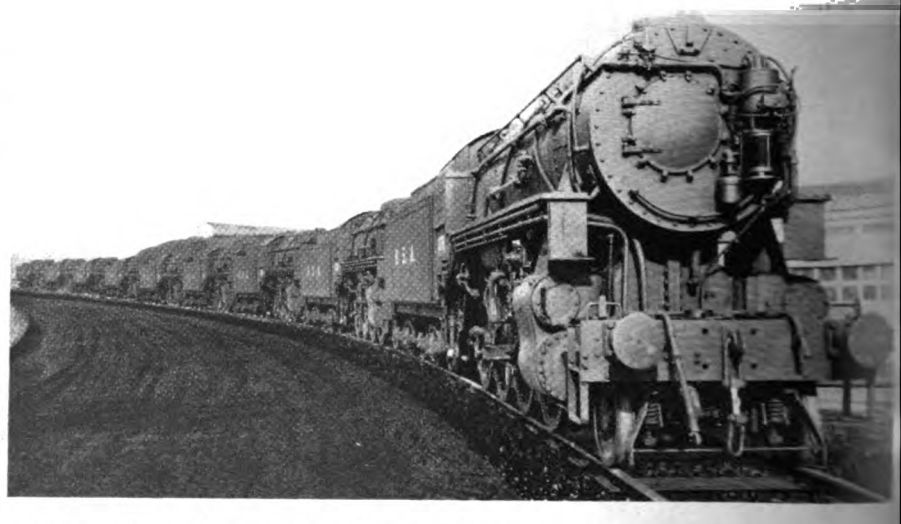
Commenting on the condition of railroad equipment, General Gross said "there is one railroad that is stumbling right now. It is beginning to have congestion. It is a sore spot." The general did not name the road, but his testimony carried the implication that it was in the West. The road, he went on, "will say" it lacks Diesel locomotives; but the general thinks there "has been an indisposition to take steam locomotives," with the result that railroads "have not put as many orders on the books for the kind [of locomotives] that they can get as I think they should.

"We have not stretched the use of the Pacific railroads as yet," General Gross continued. "When we go into the Pacific war we will throw a whole lot more onto those railroads than they now have. The Pacific coast is fed, from an expert's standpoint, by a rather tenuous rail system. . . . I believe there is a great danger because of lack of equipment. It may be that if this railroad finds itself in real and crying need for Diesels, the Office of Defense Transportation would take some away from other railroads and shoot them out."

With respect to the freight car situation, General Gross told Representative Powers of New Jersey, that the surplus is "rather low." The railroads fear most "a lack of gondolas and flat cars," although "I do not think they put this in the same category as the problem of locomotives and renewal of rail." General Gross earlier had said that there are in the rail situation "indications that the need is coming, and close, to make it almost a first priority."

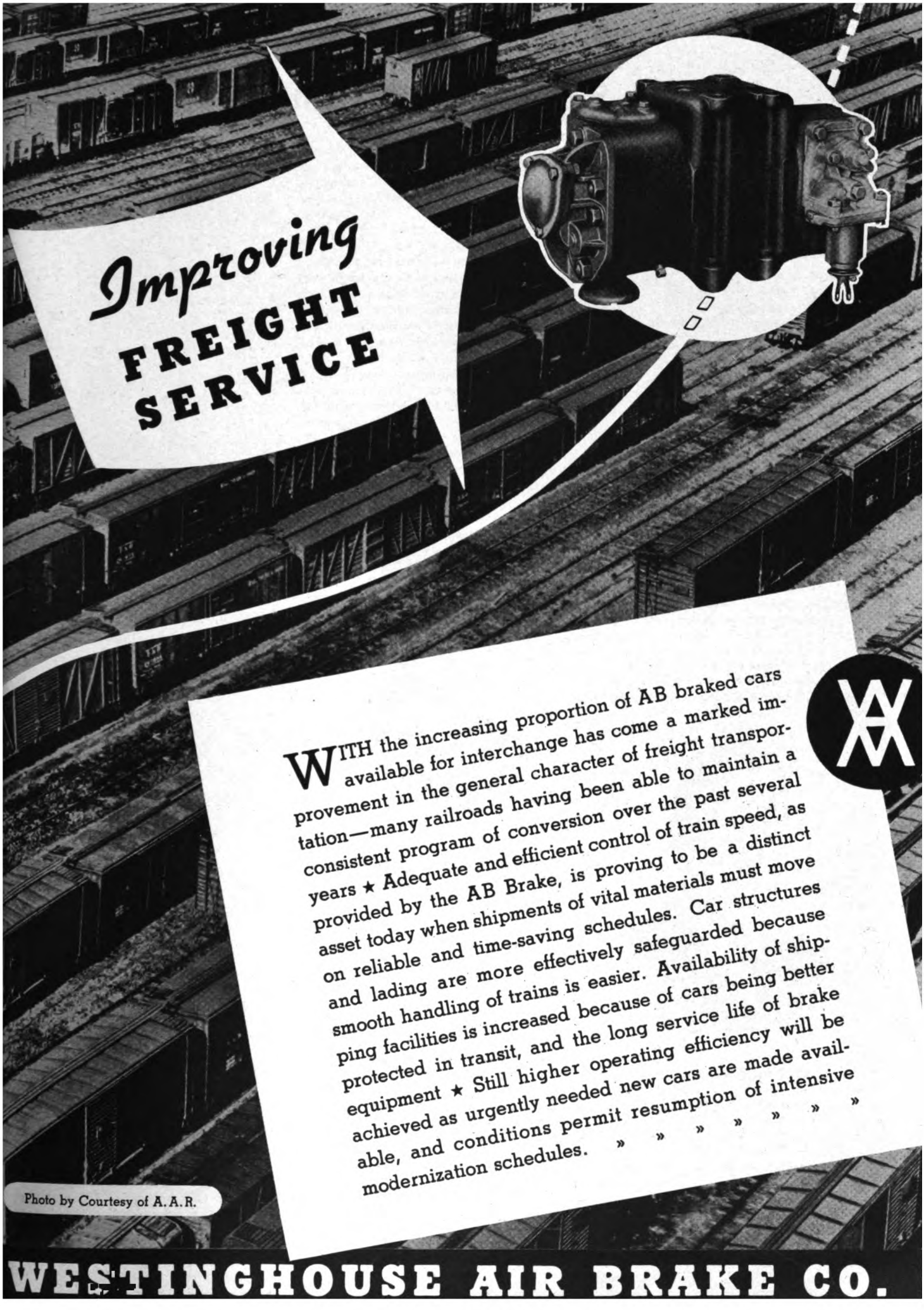
Asked by Mr. Starnes to characterize the performance of the railroads as "good," "excellent," or "superlative," General Gross told the subcommittee that the railroads have been doing a "superlative" job in meeting the requirements of the War Department. Prodded further as to government ownership, General Gross replied that the government-operation "would be a disaster." The cooperation the Army is receiving from the railroads, the General said, "could not be any better."

* * *



A string of army locomotives from Baldwin—Designed for areas where European standards prevail, as coupling and buffing mechanisms reveal

(Turn to next left-hand page)



WITH the increasing proportion of AB braked cars available for interchange has come a marked improvement in the general character of freight transportation—many railroads having been able to maintain a consistent program of conversion over the past several years ★ Adequate and efficient control of train speed, as provided by the AB Brake, is proving to be a distinct asset today when shipments of vital materials must move on reliable and time-saving schedules. Car structures and lading are more effectively safeguarded because smooth handling of trains is easier. Availability of shipping facilities is increased because of cars being better protected in transit, and the long service life of brake equipment ★ Still higher operating efficiency will be achieved as urgently needed new cars are made available, and conditions permit resumption of intensive modernization schedules. » » » » » »

Photo by Courtesy of A.A.R.

WESTINGHOUSE AIR BRAKE CO.

Supply Trade Notes

PANTASOTE CO., INC.—*Peter J. Hickey,* general sales manager, has been elected vice-president of Pantasote Co., Inc.

◆

UNITED STATES STEEL SUPPLY COMPANY.—*M. Frank Dresmal,* manager of machinery sales of the United States Steel Supply Company, has been appointed office manager of the Chicago sales department.

◆

KOPPERS COMPANY.—*E. A. Koether,* works manager since 1936 of the Koppers Company, American Hammered Piston Ring Division, has been promoted to the newly created position of technical assistant to the vice-president and general manager of the division. *Edgar S. Freeman, Jr.,* assistant sales manager, succeeds Mr. Koether as works manager.

◆

AMERICAN LOCOMOTIVE COMPANY.—*James D. Vaughan* has been appointed executive assistant to the president of the American Locomotive Company. Mr. Vaughan became associated with the company in 1937 as assistant to the then president William C. Dickerman, who is now chairman of the board.

◆

LUKENS STEEL COMPANY.—*C. T. Hansen & Company,* for twelve years representative in Detroit, Mich., of Lukens Steel Company, has been appointed Pacific Coast sales representative of Lukens and subsidiaries, By-Products Steel Corporation, and Lukenweld, Inc., Coatesville, Pa. Offices have been opened by the Hansen Company at 530 West Sixth street, Los



G. T. Hansen

Angeles, Calif.; 235 Montgomery street, San Francisco, Calif., and 1319 Second avenue, Seattle, Wash. *C. T. Hansen,* president, who has established residence in San Francisco, is in charge of these offices.

◆

DOW CHEMICAL COMPANY.—The Dow Chemical Company, Midland, Mich., has reorganized its Plastic Sales division and formed a Plastic Development and Service division. *D. L. Gibb,* who has been affiliated with the company for the last 20 years, has been made manager of the Plastics Sales division and *W. O. Goggin,* who during the seven years he has engaged in research on resins and plastics, has been placed in charge of the Plastic Development and Service division.

◆

GOULD STORAGE BATTERY CORPORATION.—*C. A. Walker* has been appointed sales engineer for Alabama, Mississippi, New Orleans and Baton Rouge in Louisiana, and Tennessee west of and including Chattanooga. His headquarters are at 649 Fulton avenue, W.E., Birmingham, Ala.

Mr. Walker studied business administration at the University of Alabama until 1934, when he left to become a manufacturer's agent for I.X.L. Laboratories of Chicago. Three years later he joined the Manhattan Rubber Mfg. Co., a division of Raybestos-Manhattan, as manager of the warehouse and service department in their Birmingham plant. In 1938 he accepted a



C. A. Walker

position with the Hood Rubber Company, a subsidiary of B. F. Goodrich, as a sales representative in Tennessee and Kentucky. He returned to the Manhattan Company in 1940 to take charge of their Southern District and become manager of the order and priorities department at the Birmingham office.

◆

ELWELL-PARKER ELECTRIC COMPANY.—*C. B. Cook,* who has been identified with the Elwell-Parker Electric Company, Cleveland, Ohio, for 28 years and has been a director since 1941, has been elected vice-president in charge of advertising, sales promotion and export sales. Mr. Cook is a graduate of Rose Polytechnic Institute. He continued his engineering education through an apprenticeship course at the Bullock Works of the Allis-Chalmers Manufacturing Company, becoming a member of its sales force in Cleveland in 1907.



C. B. Cook

From 1908 to 1912, he was manager of the Toledo office of this company, and from 1912 to 1914 was Ohio and Michigan district manager of the Stevens-Duryea Company. In 1914 Mr. Cook became affiliated with the Elwell-Parker Electric Company, to organize sales-promotion.

Army-Navy E Awards

Chambersburg Engineering Company, Chambersburg, Pa. June 25.

National Malleable and Steel Castings Company, Indianapolis, Ind. June 25.

Sylvania Electric Products, Inc., Emporium, Pa. June 22.

Obituary

WILLIAM B. GILLIES, vice-president of the Youngstown Sheet & Tube Co., Youngstown, Ohio, died in that city on June 20.

◆

CARL T. MEADE, resident manager of the Standard Stoker Company with headquarters at Montreal, Canada, died on June 21. He was 49 years of age.

◆

CHARLES PACKARD, field sales representative of the Simmons-Boardman Publishing Corporation, died suddenly at St. Paul, Minn., on July 2. He was 67 years of age. Mr. Packard was widely known among railroad and railroad supply men in the middle west. He had been associated with the Simmons-Boardman circulation department since 1926, having been formerly with the Railway Review, which was merged into the Railway Age at that time.

◆

JAMES A. SEYMOUR, former president and chairman of the McIntosh & Seymour Corporation, now a part of the American Locomotive Company, died on June 28. Mr. Seymour was 78 years of age. He was a graduate of the Sheffield Scientific School of Yale University in 1885. With John E. McIntosh, he founded the McIntosh & Seymour Corporation in 1886, and served as the company's president and, later, as chairman of the board until his retirement in 1922. The company became a wholly owned subsidiary of the American Locomotive Company in 1929, and was subsequently merged with it.

Personal Mention

General

J. S. NETHERWOOD, assistant superintendent of motive power and equipment of the Southern Pacific Lines in Texas & Louisiana, has been appointed superintendent of motive power and equipment, with headquarters as before at Houston, Tex. Mr. Netherwood was born at Lohn, Tex., on November 18, 1889, and in 1911 was a graduate in mechanical engineering from the Texas Agricultural and Mechanical college. He entered railway service in the same year as a draftsman in the employ



Joseph S. Netherwood

of the Texas & New Orleans (now part of the Southern Pacific Lines in Texas and Louisiana). In 1913 he was promoted to the position of chief draftsman at Houston and five years later became mechanical engineer. In 1924 Mr. Netherwood was appointed assistant superintendent of motive power and equipment, with headquarters at Algiers, La., and two years later was transferred to Houston.

HARRY M. WOOD, superintendent of the Logansport division of the Pennsylvania at Logansport, Ind., has been appointed general superintendent of motive power of



Harry M. Wood

the Western region, with headquarters at Chicago. Mr. Wood was born in Altoona, Pa., on June 4, 1901, and was educated at Pennsylvania State College. He entered railway service as a clerk in the Altoona shops of the Pennsylvania on July 7, 1919. He became a machinist apprentice on June 15, 1922; a special apprentice in 1925, and motive power inspector in 1927. In 1930 he went to Harrisburg, Pa., as a gang foreman and five years later became assistant foreman at Enola yard, Harrisburg. He was advanced to the position of assistant master mechanic on the Pittsburgh division in 1936, and was appointed master mechanic of the Long Island on August 1, 1937. He returned to the Pittsburgh division of the Pennsylvania as acting master mechanic on May 16, 1941; on December 1, 1941, became master mechanic of the Western Pennsylvania general division, consisting of the Pittsburgh, Conemaugh and Monongahela divisions, and in February, 1942, was promoted to the position of superintendent of the Logansport division.

DARRELL D. ALTON, assistant master mechanic of the Southern Pacific Lines in Texas and Louisiana, at El Paso, Tex., has been appointed assistant superintendent of motive power and equipment, with head-



Darrell D. Alton

quarters at Houston, Tex. Mr. Alton was born at Fremont, Mich., on July 24, 1894, and is a graduate of the University of Michigan. In 1923 he became a draftsman of the Texas & New Orleans (now part of the Southern Pacific Lines in Texas and Louisiana), with headquarters at Houston, and later served as special engineer. In 1941 Mr. Alton was advanced to the position of assistant master meechanic.

A. I. SELLERS, superintendent of shops of the Southern Pacific Lines in Texas and Louisiana at Houston, Tex., has been appointed chief assistant superintendent of motive power and equipment, with headquarters at Houston. Mr. Sellers was born at Houston on October 24, 1899, and entered railway service in 1912 as a messenger of the telegraph department at Houston. He subsequently served in various capacities in the legal department and the general claims department and in 1914 became an apprentice in the Houston shops. He served with the United States Army during World War I, and then returned



Adrian I. Sellers

to Houston in 1920 to complete his apprenticeship. Mr. Sellers served as machinist, enginehouse foreman and general shop foreman and in 1932 became superintendent of shops at Houston.

WILLIAM Y. CHERRY, general superintendent of motive power of the Western region of the Pennsylvania, with headquarters at Chicago, has retired. Mr. Cherry was born in Fort Wayne, Ind., on June 21, 1873, and entered the service of the Pennsylvania as a boilermaker apprentice at Fort Wayne on June 14, 1887. He served in various capacities until 1907, when he became machine-shop foreman at Wellsville, Ohio. He was promoted to



William Y. Cherry

the position of enginehouse foreman at Allegheny, N. Y., in 1912, and became master mechanic at Grand Rapids, Mich., in 1917. In 1920, Mr. Cherry was appointed superintendent of motive power at Cleveland, Ohio, and in February, 1928, was transferred to the Long Island. In October, 1928, he became superintendent of motive

(*Continued on second left-hand page*)

AGAIN the WAR

"The D&H"





Locomotive Characteristics

Weight on Drivers	270,000 Lb.
Weight of Engine	470,000 Lb.
Cylinders	24½ x 32 Ins.
Diameter of Drivers	75 Ins.
Boiler Pressure	285 Lb.
Tractive Power	62,040 Lb.
Tender Capacity—Water	20,000 Gals.
Tender Capacity—Fuel	25 Tons

★ ★ ★ ★ ★ ★ ★

FOR VICTORY BUY U. S. WAR BONDS AND STAMPS

TIME PACE ★ ★ ★

goes up on the

DELAWARE & HUDSON



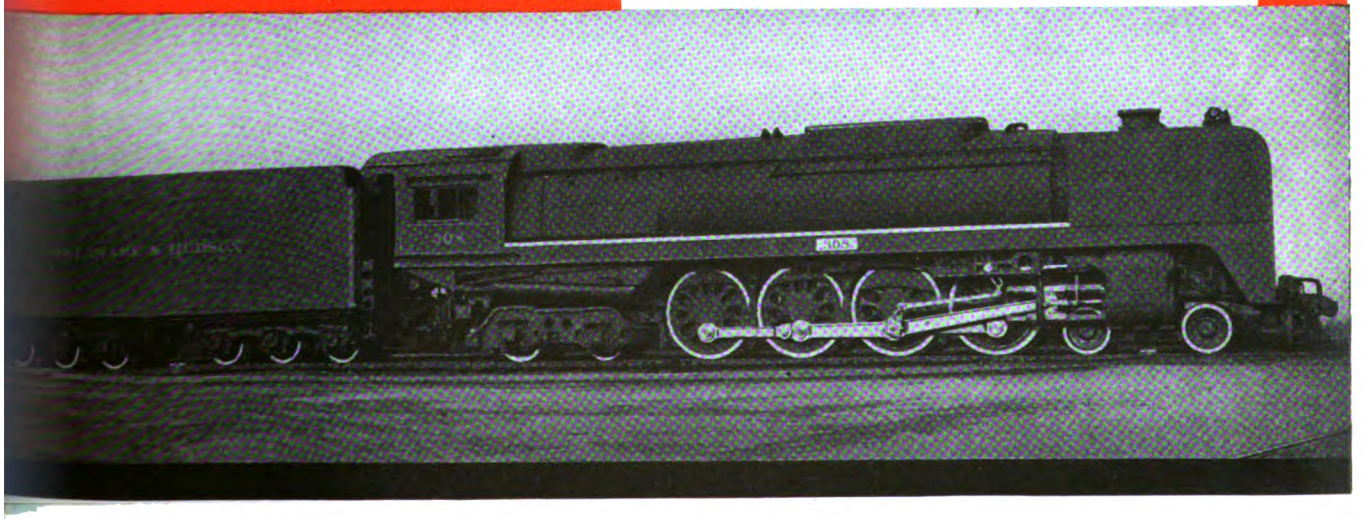
Fifteen 4-8-4's have recently been delivered by Alco to the Delaware & Hudson. This makes a fleet of 50 — fifteen 4-8-4's and thirty-five 4-6-6-4's — high-speed, high-powered, heavy tonnage locomotives which Alco has delivered to this road since July 1940.

Alco

AMERICAN LOCOMOTIVE

MANUFACTURERS OF MOBILE POWER

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, MARINE DIESELS, TANKS, GUN CARRIAGES & OTHER ORDNANCE



power of the New York zone of the Pennsylvania and on December 1, 1936, was appointed general superintendent of motive power of the Western region.

GEORGE H. MASSY, assistant superintendent of motive power and rolling equipment of the Central of New Jersey, has been appointed superintendent of motive power and rolling equipment of the Central of New Jersey, with headquarters as before at Elizabethport, N. J. Mr. Massy was born on April 25, 1889, at Jamaica, British West Indies. He entered the service of the Central of New Jersey as a helper apprentice on March 25, 1908, and



George H. Massy

became a machinist in 1910. In 1916 he was promoted to the position of assistant foreman, Bayonne (N. J.) enginehouse. On August 1, 1925, he became enginehouse foreman at Elizabethport engine terminal; on March 17, 1926, general mechanical inspector at New York; on March 1, 1929, assistant master mechanic at Communipaw (N. J.) engine terminal; on January 1, 1933, division master mechanic in charge of the Central and Southern subdivisions, and in January, 1942, assistant superintendent of motive power and rolling equipment.

GEORGE A. SILVA, superintendent of the Billerica (Mass.) locomotive repair shops of the Boston & Maine, has been appointed superintendent of locomotive maintenance of the Boston & Maine, Maine Central and the Portland Terminal Company, with headquarters at Boston, Mass., and Portland, Me.

H. S. WALL, mechanical superintendent of the Atchison, Topeka & Santa Fe at Los Angeles, Calif., retired on July 1 after 43 years' service. Mr. Wall was born at Hamilton, Ont., on August 24, 1874, and entered the employ of the Santa Fe in October, 1899, as a machinist at Albuquerque, N. M. On April 1, 1900, he was appointed enginehouse foreman at Needles, Calif. On July 1, 1900, he became general foreman; on August 15, 1900, division foreman at Barstow, Calif.; May 1, 1906, master mechanic at Winslow, Ariz.; on October 21, master mechanic at Needles; on July 1, 1909, shop superintendent at San Bernardino, Calif., and in April, 1918, mechanical superintendent at Los Angeles.

JOHN A. POWER, superintendent of motive power and equipment of the Southern Pacific Lines in Texas and Louisiana, with headquarters at Houston, Tex., has retired. Mr. Power was born in Ireland in 1873. On coming to America he took employment with the Texas & New Orleans, now a part of the Southern Pacific, in Texas and Louisiana, in 1893, as an apprentice in the mechanical department. Subsequently, he became a machinist, gang foreman, machine-shop foreman, enginehouse foreman, general foreman and superintendent of shops. In 1916 he was appointed assistant general manager, with headquarters at Houston; in August, 1918, mechanical superintendent, and in 1920, superintendent of motive power and equipment.

GEORGE S. WEBB, master mechanic of the Chicago Terminal and Logansport divisions of the Pennsylvania, has been appointed superintendent of motive power of the Southern division, with headquarters at Wilmington, Del., succeeding H. H. Maxfield, who has been granted leave of absence.

JAMES W. ATKINSON, division master mechanic of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed mechanical superintendent at Ft. Madison, Ia.

G. B. HALSTEAD, general foreman, car department, of the Virginian, has been appointed assistant to superintendent motive power, with headquarters as before at Princeton, W. Va.

Car Department

E. D. GRIFFITH has been appointed general car inspector of the Southern Pacific, with headquarters at San Francisco, Calif.

E. M. FORBES, car foreman of the Virginian at Elmore, W. Va., has been appointed general foreman, car department, at Princeton, W. Va.

Master Mechanics and Road Foremen

C. L. EMERSON, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Chicago, has retired.

J. J. MEYERS, supervisor of locomotive maintenance of the New York, Ontario & Western, has been promoted to the position of master mechanic at Middletown, N. Y.

M. T. LLEWELLYN, general foreman of the Chesapeake & Ohio at Clifton Forge, Va., has been appointed to the newly created position of master mechanic at Ashland, Ky.

L. H. RABUN, assistant master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Bensonville, Ill., has been appointed master mechanic, with headquarters at Savanna, Ill.

P. B. RICE has been appointed master mechanic of the Southern Pacific, Lines in Texas and Louisiana, with headquarters at Houston, Tex.

J. R. KEELEY, acting master mechanic of the Virginian at Victoria, Va., has been appointed master mechanic at Victoria.

STANLEY W. SHIRLEY, assistant master mechanic of the Eastern division of the Pennsylvania at Conway, Pa., has been appointed master mechanic of the Chicago Terminal and Logansport divisions, with headquarters at Chicago.

JOHN G. DANNEBERG, master mechanic of the Atchison, Topeka & Santa Fe at Arkansas City, Kan., has been appointed division master mechanic, with headquarters at Argentine, Kan.

Shop and Enginehouse

J. E. POHLMAN, erecting shop foreman of the New York, Ontario & Western, has been promoted to the position of general foreman at Middletown, N. Y.

H. J. BOWYER, acting general locomotive foreman of the Southern Pacific Lines in Texas and Louisiana, has been appointed superintendent of shops at Houston, Tex.

G. BLYBORG, general foreman of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis, Minn., has been appointed shop superintendent, with headquarters at Minneapolis.

WALTER H. OHNESORGE, assistant superintendent of the locomotive repair shops of the Boston & Maine at Billerica, Mass., has been appointed superintendent of the locomotive repair shops at Billerica.

LEROY E. LEONARD, a draftsman in the employ of the New York, Ontario & Western, has been promoted to the position of shop engineer, with headquarters at Middletown, N. Y.

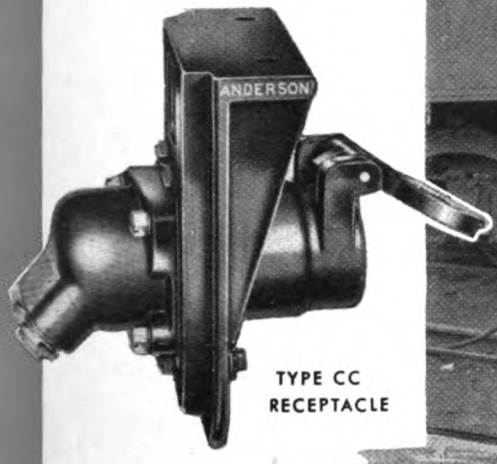
Obituary

H. E. RICCUS, shop superintendent of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis, Minn., died in that city on June 6.

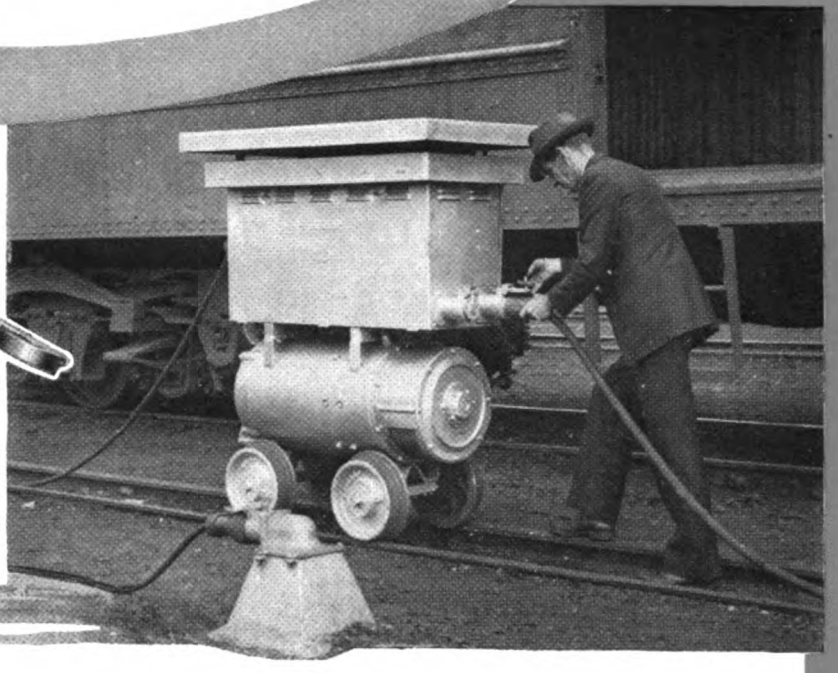
EDWIN J. KUECK, assistant superintendent of motive power of the St. Louis Southwestern at Pine Bluff, Ark., died in a hospital at Texarkana, Ark., on June 23. A sketch and photograph of Mr. Kueck appeared in the May *Railway Mechanical Engineer* at the time of his appointment to the position of assistant superintendent of motive power.

BENJAMIN E. JONES, master mechanic of the Erie at Secaucus, N. J., died suddenly at his home in Rutherford, N. J. on June 12. Mr. Jones entered the employ of the Erie at Marion, Ohio, in 1913 and served in various positions there until March, 1930, when he was appointed general supervisor of motor cars at the New York general offices. Later that year he went to Hornell, N. Y., as master mechanic. In 1932 he became general supervisor of motor cars at Cleveland, Ohio, and, in 1933, master mechanic, motor equipment, Susquehanna. He was master mechanic at Buffalo, N. Y., from March 1, 1938, to October 1, 1941, when he was transferred to Secaucus.

ALL ANDERSON PLUGS AND RECEPTACLES IN THIS INSTALLATION



TYPE CC RECEPTACLE



MODERN passenger car yards require sturdy Anderson charging receptacles, cables and plugs to withstand the intensive service incident to war conditions. This shows a recent installation with Type F-4 receptacles mounted on a concrete base and fed by underground conduit as the supply line while two Type CX receptacles are connected with the motor generator charging set. Anderson Eitherend Connectors are provided on all runs of cable thus saving reversing the leads. Other Anderson railroad products include Plugs and Receptacles for Air Conditioning, Battery Charging, Marker Lights, Yards and Platforms, Portable Tools, Telephones, Switchboards, Welding, Cable Connectors, Turntables and Industrial Trucks.



ALBERT and J.M. ANDERSON MFG. CO.

289-305 A Street, Boston, Mass.

IEW YORK CHICAGO PHILADELPHIA LONDON

1887 1943

★ ★ ★ ★ ★ ★ LeBLOND CINCINNATI, OHIO USA ★ ★ ★ ★ ★ ★

What You See Depends Mainly on What You Look For

LeBLOND BUILDS

ENGINE LATHES
12 to 50" Heavy Duty

TOOL ROOM
12 to 18" Precision Lathes

THE REGAL LINE
13 to 24" Light Type Engine Lathes
13 to 19" Light Type Tool Room Lathes

THE RAPID PRODUCTION LATHE
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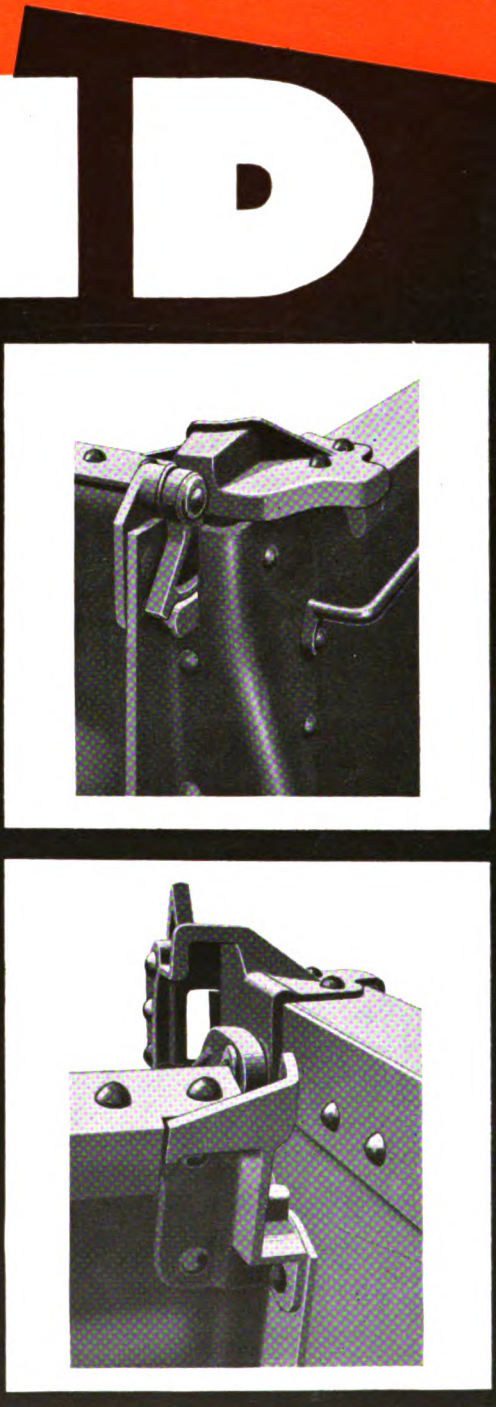
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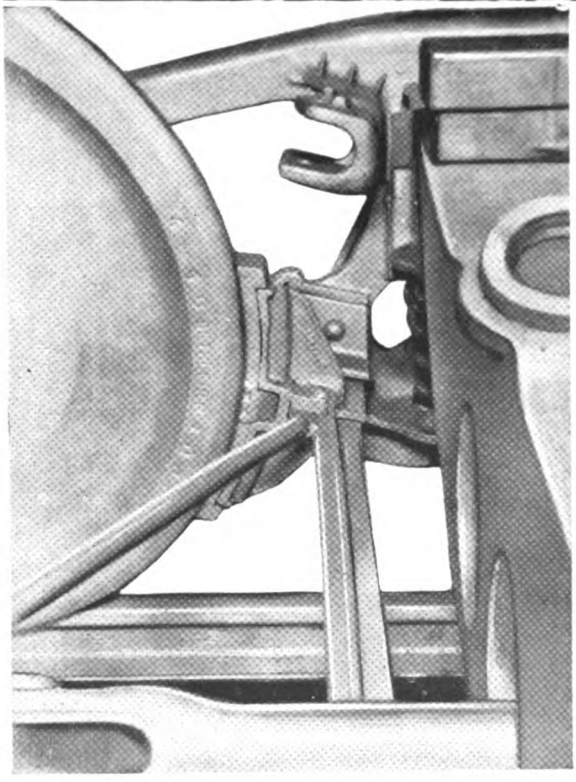
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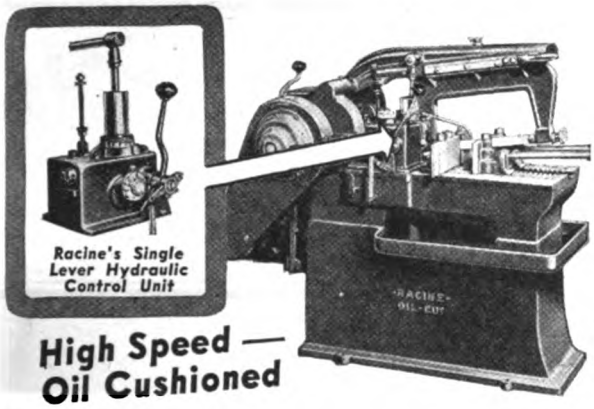
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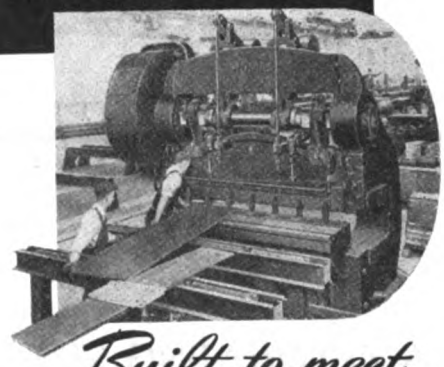
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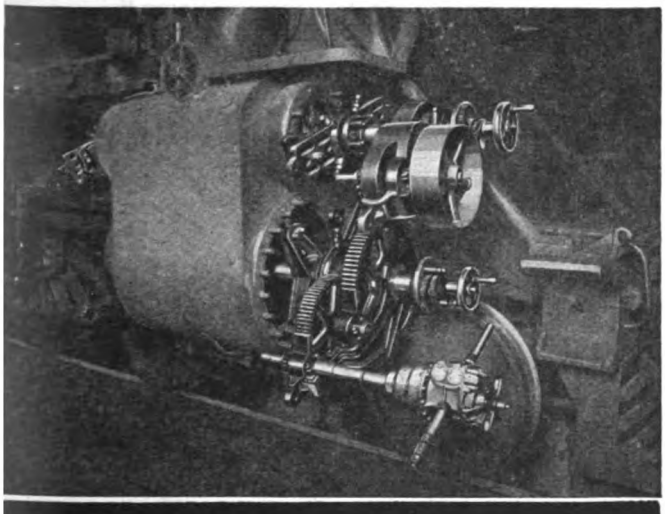
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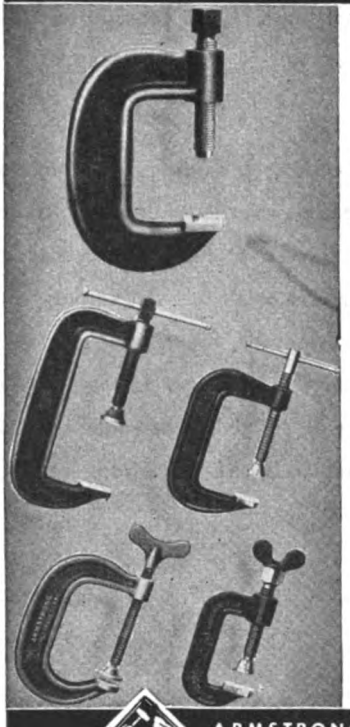
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THE EDITOR'S DESK

A FASCINATING STORY

Industry, in its all-out effort to increase production, has made a profound contribution to the winning of the war. For strategic and other reasons some of its most purposeful and dramatic contributions have not been disclosed. The railway supply group has had its share in these unusual achievements, the recital of some of which leaves one almost spellbound. Private enterprise, upon which the progress and prosperity of this country is based, has received little consideration in many places, and some of these stories may never be told, or not be told effectively, unless industry itself sees to it that the facts are brought to light at the proper time.

Many public bodies, including government bureaus and departments, have on the public payrolls experts, classed as historians or otherwise, who in the midst of all this war activity are keeping historical records for future use and reference. What may it not mean to the railway supply industries, who are giving such an excellent account of themselves in the war effort, if they, too, not only keep a careful record of their wartime achievements, but see to it that they are not buried in a mass of dry statistics, but are dramatized in such a way that they can be driven home to the public?

Many new and unusual devices and products have been produced in vast quantities. Yes, but in that connection, unusual talent has often been displayed, or the exercise of almost superhuman energy and effort has insured these products reaching the right place at the right time.

Such records would seem to warrant retaining the best of talent to place them on record in a forceful and readable way. Unfortunately it is not at all unlikely that private enterprise may need all of the help that it can summon to protect itself in the days to come.

Roy V. Wright

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(Name Registered, U. S. Patent Office)
With which is incorporated the RAILWAY ELECTRICAL ENGINEER.

Founded in 1832 as the American Rail-Road Journal

SEPTEMBER, 1943

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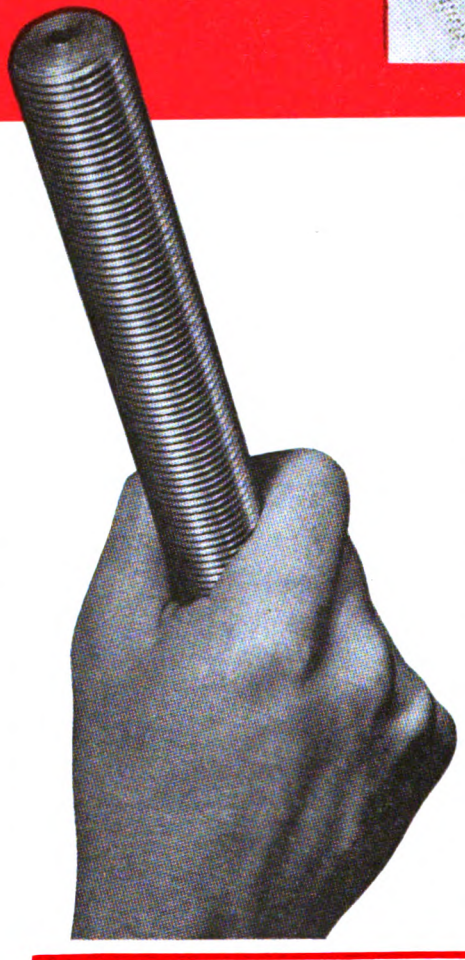
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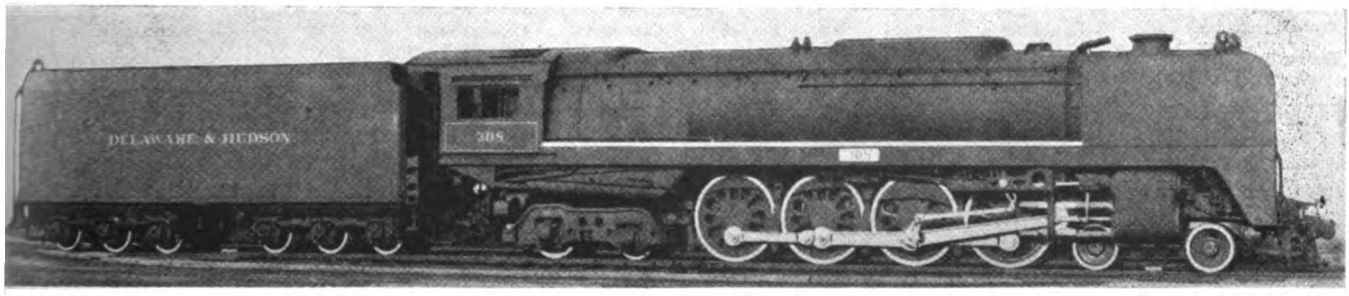
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D. & H. 4-8-4 Locomotives

Fifteen Alco-built units for fast freight service have a rated tractive force of 62,040 lb. with 285-lb. boiler pressure and 75-in. driving wheels

DURING the early part of this year the American Locomotive Company made delivery to the Delaware & Hudson of 15 fast freight locomotives of the 4-8-4 type designed especially for service between Oneonta, N. Y., and Rouses Point, a distance of 243 miles. These locomotives have a rated tractive force of 62,040 lb. with 75-in. wheels and 285-lb. boiler pressure. The total weight on drivers is 270,000 lb. and the total engine weight is 470,000 lb. The weight of the tender with a two-thirds load of fuel and water is 298,000 lb.

Engine Bed and Running Gear

The foundation of these locomotives is a cast steel bed supplied by the General Steel Castings Corporation. Cast integral with the bed are the front deck plate, air-compressor brackets, engine-truck center plate, cylinders, back cylinder heads, guide-yoke crossties, air reservoirs, coil spring seats, brake-hanger brackets, footplate and boiler supports. The engine-trucks have the Alco geared roller centering device with an initial resistance of 15 per cent in the first 1 in. of travel and a constant resistance of 33⅓ per cent throughout the remaining lateral-motion range. The engine-truck centers are located 2 in. ahead of the cylinder centers for clearance on 20-deg. curves. The trailer-trucks are the General Steel Castings outside bearing type. The front, main and intermediate driving wheels are equipped with the Alco lateral cushioning device, having ⅜ in. lateral at the main and intermediate wheels and ⅝ in. at the front. The details of the axle, bearing and wheel equipment of both engine and tender are included in a table.

Crossbalancing is used at the main drivers, while the other driving wheels are statically balanced. The total weight of the reciprocating parts on one side of the locomotive is 2,130 lb., 25 per cent of which is balanced. The over-balance is equally distributed among the four wheels. The cylinders are 24½ in. bore by 32 in. stroke. Both the cylinders and the valve chambers are fitted with Hunt-Spiller gun-iron bushings. The pistons, piston rings, valves, bull rings and packing rings are also Hunt-Spiller gun-iron.

An interesting detail with respect to the cylinders is the fact that the clearance volume is only nine per cent. The crossheads are of the alligator type with heat-treated cast-steel bodies, chrome-vanadium keys and Magnus bronze shoes. Both wrist pins and crank pins are medium carbon steel. The side and main rods are medium carbon steel with Magnus brasses. The driving rods are channeled.

Walschaert valve gear is used with Alco type G power reverse gear mounted on the bed. The 12-in. piston valves have 7½-in. travel.

The spring rigging is of the same general design as the J-95 4-6-6-4 type locomotives, built for the D. & H. in 1940,* with continuous equalization on each side from the front driver to rear trailer and utilizing coil springs at the dead ends of the rigging system.

Lubrication

Mechanical lubrication is used on cylinders, valves, stoker, combination levers, valve-stem and main guides, engine-truck center pin and rockers, hub liners, shoes and wedges, trailer-truck center pin, radial buffer and trailer wheel flanges. A 36-pint, 16-feed lubricator is located on the right side and a 32-pint, 14-feed unit on the left side.

Grease lubrication is used for bell trunnions, brake

* For a description of these locomotives see page 337 of the September, 1940, *Railway Mechanical Engineer*.

Axles, Bearings, Wheel Centers and Tires

Location	Axles: Material	Axles: Bearings	Axles: Journal size, in.	Wheel Centers: Type	Wheel Centers: Material	Wheel Centers: Manufacturer	Wheel Centers: Diameter in.	Wheels or Tires: Diameter in.	Wheels or Tires: Manufacturer
Front truck....	Carbon steel	SKF roller	7.876 diam.	....	....	....	..	36	Bethlehem Steel Co.
Drivers, main..	Carbon steel	SKF roller	13.784 diam.	Boxpok	Cast steel	General Steel Castings Corp.	68	75	Midvale Co.
Drivers, inter...	Carbon steel	SKF roller	12.603 diam.	Boxpok	Cast steel	General Steel Castings Corp.	68	75	Midvale Co.
Drivers, front and back,....	Carbon steel	Plain	11½x13	Boxpok	Cast steel	General Steel Castings Corp.	68	75	Midvale Co.
Trailer, front...	Carbon steel	Plain	7x14	....	....	....	..	36	Armco
Trailer, rear...	Carbon steel	Plain	9x14	Boxpok	Cast steel	General Steel Castings Corp.	38	45	Midvale Co.
Tender trucks..	Carbon steel	Plain	7x14	....	....	....	..	36	Bethlehem (8) Carnegie-Illinois (7)

levers, main and side rods, eccentric rod, reverse-shaft bearings, spring hangers, throttle rigging and drawbar pins.

The Boiler

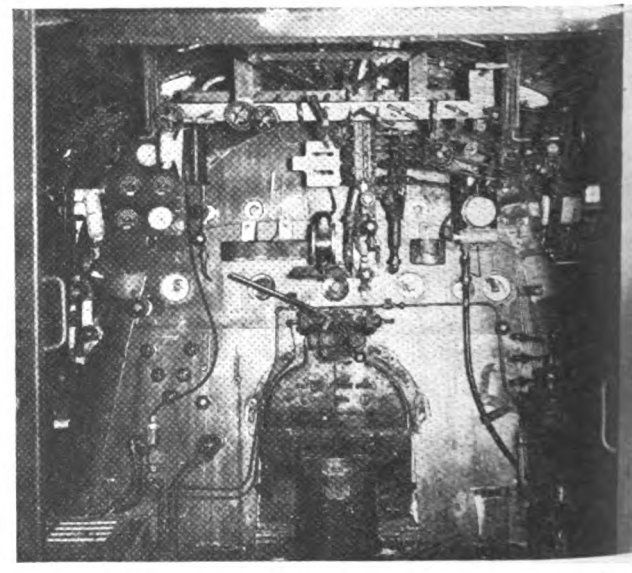
The boiler is the conical type having an inside diameter of 84¼ in. at the first ring and an outside diameter of 98 in. at the third ring. The barrel courses are fabricated from carbon steel with butt joint, multiple-riveted longitudinal seams. The Elesco Type A superheater has 58 units in 5½-in. No. 8 flues. In addition, there are 199 2¼-in. No. 12 tubes. The superheater is equipped with a damper cylinder. An American multiple throttle is incorporated in the header.

The grate area is 96.2 sq. ft. The fuel, bituminous coal, is fed to Firebar grates by a Standard HT stoker, with the stoker engine on the tender. The fire door is the Franklin No. 8.

The fireboxes are completely welded. Seal welding is

Partial List of Materials and Equipment on the Delaware & Hudson 4-8-4 Type Locomotives

Engine bed; trailing trucks; bumpers	General Steel Castings Corp., Eddystone, Pa.
Crosshead castings	Adirondack Foundries & Steel Co., Watervliet, N. Y.
Driving-box compensators and snubbers; radial buffers	Franklin Railway Supply Co., Inc., New York
Engine-truck wheels	Bethlehem Steel Co., Bethlehem, Pa.
Trailing wheels, front	Armco Railroad Sales Co., Middletown, Ohio
Wheel centers—driving and back-trailer	General Steel Castings Corp., Eddystone, Pa.
Driving- and trailing-truck tires	Midvale Co., Nicetown, Philadelphia
Lateral cushioning device; Slidguide attachment; engine trucks	American Locomotive Co., New York
Bearings	SKF Industries, Philadelphia, Pa.
Driver brake	New York Air Brake Co., Watertown, N. Y.
Brake shoes	American Brake Shoe Company, New York
Driving-box lubricators	Franklin Railway Supply Co., Inc., New York
Dust guards	MacLean-Fogg Lock Nut Co., Chicago
Pilot coupler	National Malleable and Steel Castings Co., Cleveland, Ohio.
Springs, driving and truck	Crucible Steel Co. of America, New York Union Spring & Mfg. Co., New Kensington, Pa.
Spring clip pads	Fabreeka Products Co., Boston, Mass.
Bronze castings	Magnus Metal Div., National Lead Co., New York
Running boards	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Boiler steel	Carnegie-Illinois Steel Corp., Pittsburgh, Pa. Jones & Laughlin Steel Corp., Pittsburgh, Pa. Lukens Steel Co., Coatesville, Pa.
Lagging	Johns-Manville Sales Corp., New York
Staybolt iron	Ewald Iron Co., Louisville, Ky. Jos. T. Ryerson & Son, Inc., Chicago Ulster Iron Works, Dover, N. J.
Flexible and water-space staybolts	American Locomotive Company, New York Flannery Bolt Co., Bridgeville, Pa.
Boiler tubes	Pittsburgh Steel Corp., Pittsburgh, Pa. Republic Steel Corp., Massillon, Ohio
Superheater flues; firebrick tubes	National Tube Co., Pittsburgh, Pa.
Grates	Waugh Equipment Co., New York
Stoker	Standard Stoker Co., Inc., New York
Firebrick	American Arch Co., Inc., New York
Fire doors	Franklin Railway Supply Co., Inc., New York
Washout and arch-tube plugs	Huron Mfg. Co., Detroit, Mich.
Lock washers	Positive Lock Washer Co., Newark, N. J.
Headers with throttle assembly	American Throttle Co., New York
Smokebox inspection plugs; blower nozzle	T-Z Railway Equipment Co., Chicago
Damper cylinder; exhaust-steam injectors; superheater pipes	The Superheater Company, New York
Pipe fittings	Crane Co., Chicago
Wrought-iron pipe	A. M. Byers Co., Pittsburgh, Pa.
Copper pipe	The American Brass Company, Waterbury, Conn.
Non-lifting injectors; coal sprinkler; universal joints	Locomotive Equipment Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Blow-off cocks and cylinders	The Okadee Company, Chicago
Gauge cocks; water gauges	Nathan Manufacturing Co., New York Talmadge Manufacturing Co., Cleveland, Ohio
Flexible joints between engine and tender	Barco Manufacturing Co., Chicago
Packing	The Garlock Packing Company, Palmyra, N. Y. Johns-Manville Sales Corp., New York
Cylinder and valve bushings	Hunt-Spiller Manufacturing Corporation, Boston, Mass.
Asbestos tubing; Wovenstone	Union Asbestos & Rubber Co., Chicago
Piston-rod and valve-stem packing	Paxton-Mitchell Co., Omaha, Neb.
Reverse gears	American Locomotive Co., New York
Mechanical lubricators	Detroit Lubricator Co., Detroit, Mich. Nathan Manufacturing Co., New York
Flange oiler shoes	Detroit Lubricator Co., Detroit, Mich.



The cab has sliding rear doors—There are two seats on the left side

Grease fittings	The Prime Manufacturing Co., Milwaukee, Wis.
Cab seats	Heywood-Wakefield Co., Gardner, Mass.
Windows and windshields	The Prime Manufacturing Co., Milwaukee, Wis.
Floor plates	Jos. T. Ryerson & Son, Inc., Chicago
Safety valves	Locomotive Equipment Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Steam-heat gauge; steam gauges	Ashton Valve Co., Boston, Mass.
Steam-heat reducing valve	The Leslie Co., Lyndhurst, N. J.
Sand spreaders	Graham-White Sander Corp., Roanoke, Va.
Sander	U. S. Metallic Packing Co., Philadelphia, Pa.
Headlights and generator; back-up, classification and marker lamps	The Pyle-National Company, Chicago
Speed recorder	Valve Pilot Corporation, New York
Whistle and operating valve	Viloco Railway Equipment Co., Chicago
Bell ringer	Railway Service and Supply Corp., Indianapolis, Ind.
Tender:	
Trucks; frames	General Steel Castings Corp., Eddystone, Pa.
Wheels	Bethlehem Steel Co., Bethlehem, Pa. Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Clasp and body brakes	American Steel Foundries, Chicago
Tank valves	T-Z Railway Equipment Co., Chicago
Steam-heat coupler	Vapor Car Heating Co., Inc., Chicago
Draft gear	W. H. Miner, Inc., Chicago
Couplers	National Malleable & Steel Castings Co., Cleveland, Ohio

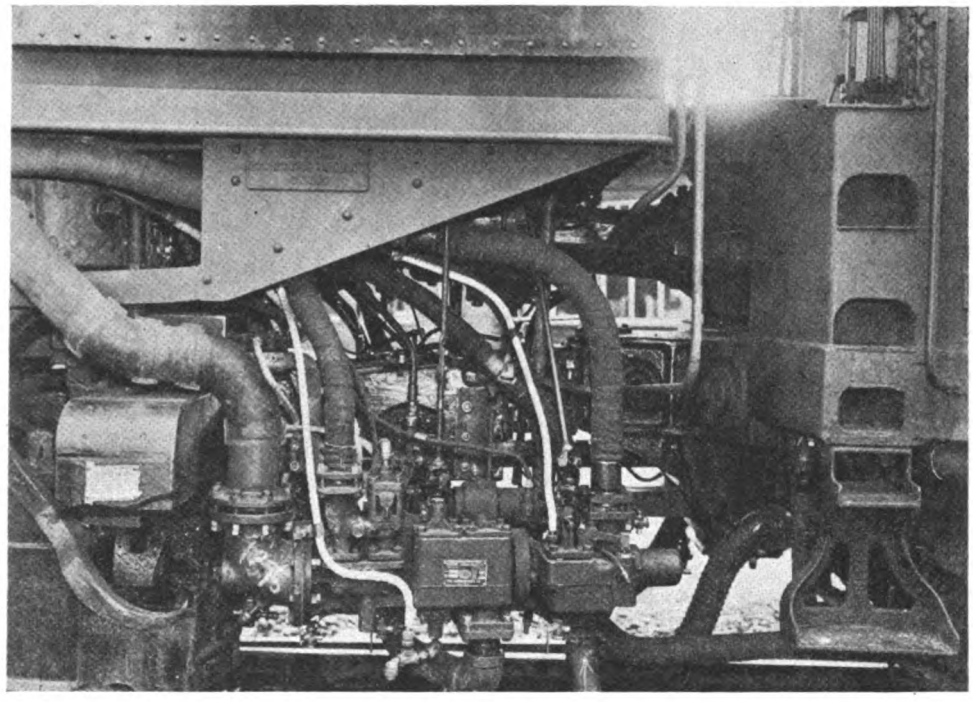
tubes which are rolled into ported forged-steel sleeves at the throat-sheet ends. These sleeves extend through the water space and are threaded and welded to the inside and outside sheets. The outer end is closed with square threaded plugs. This design of arch tube and sleeve was developed by the Canadian Pacific.

Water is fed to the boilers by a Hancock Type W nonlifting injector located on the right side and an Elesco exhaust-steam injector on the left side. The safety valve equipment consists of three 3-in. Consolidated-Ashcraft-Hancock valves.

The Cab

The cab is supported by brackets to the firebox. The firebox is carried on four expansion shoes moving in an oil bath. The cab is built of No. 10 gage steel, wood lined. Safety glass is used in the metal-sash windows. Prime windshields and clear-vision windows are part of the cab equipment. There is one seat on the right side and two seats on the left side.

An interesting feature of these cabs is the sliding rear doors which give cold-weather protection without hot weather discomfort. The gages on the left side of the



Engine and tender connections as seen from the left side

used at the throat-sheet connections to the third ring, along part of the roof-sheet seam, along the longitudinal seams between the roof and side sheets, and at the firebox corners. Welding is also used on the smokebox liner and the seams around the flattened smokebox sides, on the seam between the outside firebox sheets and back head, and between the back head and door sheets. The door sheets are built up to a thickness of 5/8 in. by 4 3/4 in. diameter at the arch-tube openings by means of welding.

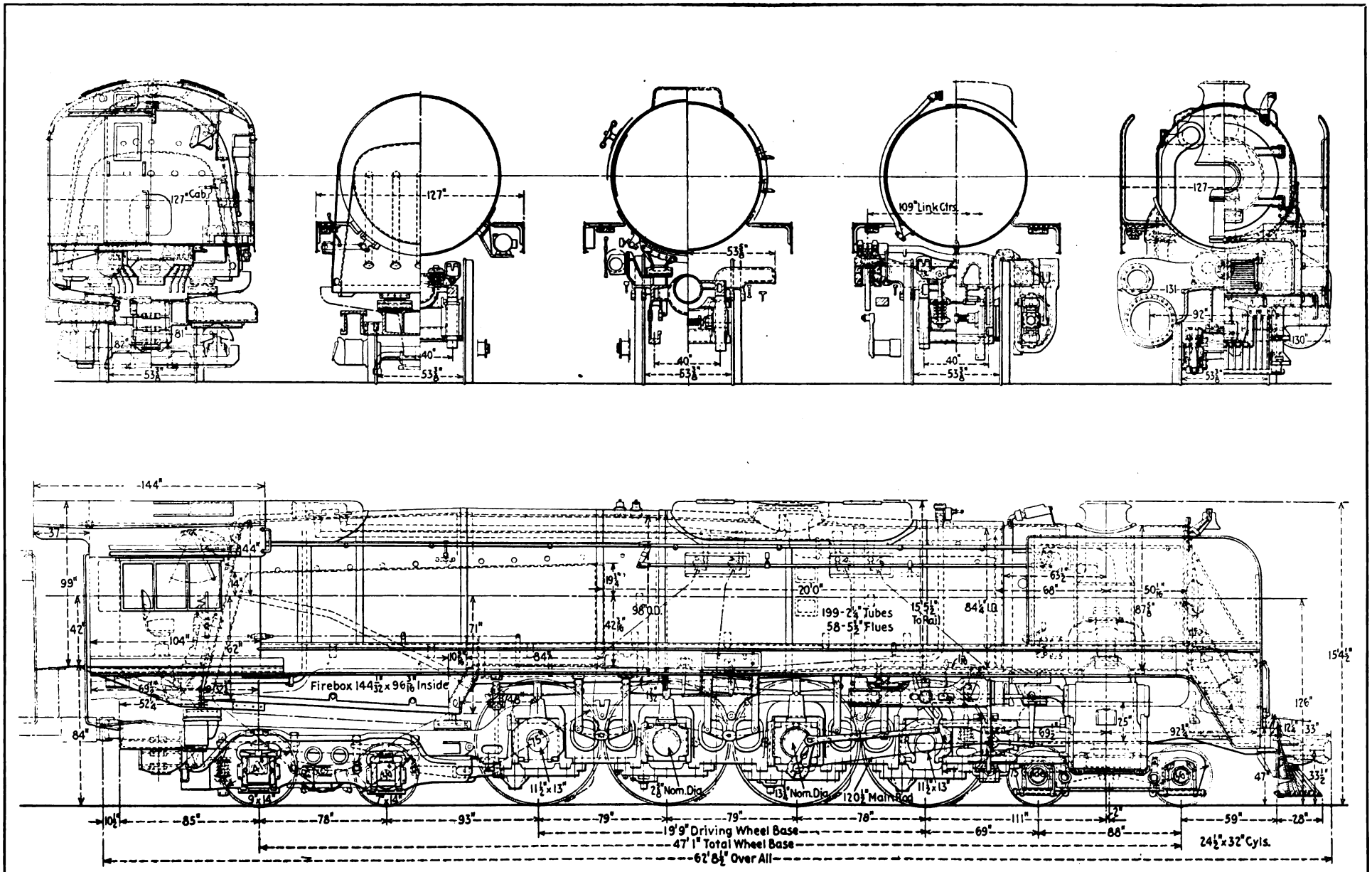
There is a complete installation of flexible staybolts in the combustion chamber of this boiler and the installation in the throat sheet is complete except for the bottom row. Flexible stays are also used in the breaking zones of the side sheets and in the two rows of the door-sheet-to-back-head connection.

The American arch is supported by five 4-in. arch

back head are combined in the same type of air-cooled, illuminated case as used on the J-95 locomotives.

The brake equipment is No. 8 ET furnished by the New York Air Brake Company with remote-control relay valves and ET safety valves set at 68 lb. Two 8½-in. cross-compound compressors operating on superheated steam are mounted on the front end of the bed. Fin type radiators with sump reservoirs and automatic drain complete the compressor system. The total capacity of air storage is 89,062 cu. in. The foundation driver brake is the equalized type with brake shoes at the rear of the wheels. The braking ratio is 60 per cent at 50 lb. cylinder pressure.

Other locomotive equipment consists of King Sanders and operating valves; Sweeney type exhaust nozzles; Valve Pilot speed recorder; Franklin drawbars, safety bars and E-2 radial buffer between the engine and tender;



Elevation and cross sections of D. & H. 4-8-4 locomotives

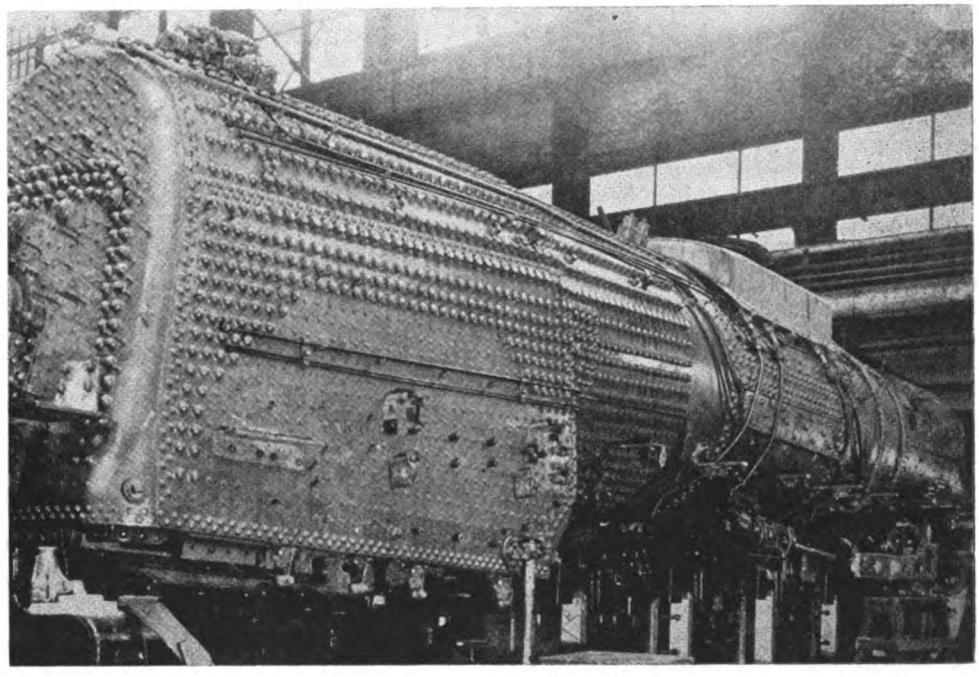
)kadee blow-off and cylinder cocks, and Talmage water ages.

The appearance of these locomotives is greatly enanced by clean cut exterior design with long covers over and box and dome and the runboard design blended in ith that of the side plates and front-end trim. The side lates function to keep smoke and steam from obscuring ie engineman's view. The engine number is in a lightl panel at the center of the runboard. The classificaon lamps are mounted on brackets of sufficient height) be visible over the side plates to a man on the ground.

The Tender

The tender is of the rectangular tank design with a eneral Steel Castings Corporation water-bottom frame. t follows the same general design as those built for the lass J-95. The capacity is slightly less, being 20,000 gallons of water and 25 tons of coal. The principal difference between this and the tender for the earlier class is in the height of the water space.

The trucks are the General Steel Castings Corporation six-wheel equalized type with 7-in. by 14-in. journals, 36-in. rolled-steel wheels, Miner rocking roller-type side bearings, and A. S. F. clasp brakes. Miner draft rigging is used with National Malleable couplers and A. A. R. swivel yokes. The flexible connectors for air brake, air signal, steam heat, and stoker engine steam lines between engine and tender are the Barco type 3VX. The Vapor connector is used at the rear of the tender.



One of the boilers in the erecting shop before application of lagging and jacket

Principal Dimensions, Weights and Proportions of the Delaware & Hudson 4-8-4 Type Freight Locomotive

Railroad	D. & H.
Builder	American Locomotive Co.
Road class	K-62
Road numbers	300–314
Date built	April, 1943
Service	Fast freight
Dimensions:	
Height to top of stack, ft.-in.	15–4½
Width overall, in.	127
Height to center of boiler, ft.-in.	10–6
Cylinder centers, in.	92
Weights in working order, lb.:	
On drivers	270,000
On front truck	92,500
On trailing truck	107,500
Total engine	470,000
Tender (¾ load)	298,000
Wheel bases, ft.-in.:	
Driving	19–9
Engine, total	47–1
Engine and tender, total	91–7
Wheels, diameter outside tires, in.:	
Driving	75
Front truck	36
Trailing truck:	
Front	36
Back	45
Engine:	
Cylinders, number, diameter and stroke, in.	2–24½x32
Valve gear, type	Walschaerts
Valves, piston type, size, in.	12
Maximum travel, in.	7½
Steam lap, in.	1⅜
Exhaust clearance, in.	⅛
Lead, in.	¼
Cutoff in full gear, per cent	82.5
Boiler:	
Type	Conical
Steam pressure, lb. per sq. in.	285
Diameter, first ring, inside, in.	84¼
Diameter, largest, outside, in.	98
Firebox length, in.	144–1/32
Firebox width, in.	96–3/16
Height center line to crown sheet, back, in.	14
Height center line to crown sheet, front, in.	19¾
Combustion chamber length, in.	84
Arch tubes, number and diameter, in.	5–4
Flues, number and diameter, in.	58–5½
Tubes, number and diameter, in.	199–2¼
Length over tube sheets, ft.-in.	20–0
Net gas area through tubes and flues, sq. ft.	10
Grate area, sq. ft.	96.2
Heating surfaces, sq. ft.:	
Firebox and comb. chamber	427
Arch tubes	55
Firebox, total	482
Tubes	2,333
Flues	1,662
Evaporative, total	4,477
Superheater	1,473
Combined evap. and superheater	5,950
Tender:	
Type	Rectangular "U"
Water capacity, gals.	20,000
Fuel capacity, tons	25
Trucks	Six-wheel
Rated tractive force, engine, 85 per cent, lb.	62,040
Weight proportions:	
Weight on drivers ÷ weight engine, per cent	51.06
Weight on drivers ÷ tractive force	4.35
Weight of engine ÷ evaporation	104.09
Weight of engine ÷ comb. heating surface	68.92
Boiler proportions:	
Firebox heating surface, per cent comb. heating surface	6.93
Tube-flue heating surface, per cent comb. heating surface	57.44
Superheater heat. surface, per cent comb. heating surface	21.20
Firebox heat. surface ÷ grate area	5.01
Tube-flue heat. surface ÷ grate area	41.53
Superheater heat. surface ÷grate area	15.31
Comb. heat. surface ÷ grate area	72.24
Gas area, tubes–flues ÷ grate area	0.104
Evaporative heat. surface ÷ grate area	46.54
Tractive force ÷ grate area	644.90
Tractive force ÷ evaporative heat. surface	13.85
Tractive force ÷ comb. heat. surface	8.92
Tractive force x diameter drivers ÷ comb. heat. surface	669.49

Lubrication and Hot Boxes*

By D. A. Reavis†

WHEN speaking or writing on lubrication and hot boxes it should be borne in mind that conditions contributing to hot boxes may not be alike on all railroads. There are, however, certain general conditions that exist on the majority of railroads that are beyond the control of the railroads individually.

The number of hot boxes can be cut down by adequate inspection forces, properly trained, but due to the numerous other factors that contribute to hot boxes, universal action of all railroads is necessary to obtain perfection. It is also felt that some of our present practices, as well as the design of journal box and parts need to be changed or improved before hot boxes can be substantially reduced.

The present friction journal bearing was adopted over 80 years ago and still consists of the same basic design and principle of lubrication as when first designed. When the design was first adopted the average train speed was very slow and the average lading per car was less than twenty tons. Neither did we have the rough handling of such equipment by hump switching in terminals.

Under present-day operation it is common for freight trains to operate at 60 miles an hour, with each car carrying from forty to one hundred tons.

It is more important now than ever before that hot boxes be kept to an absolute minimum. With the existing shortage of cars and locomotives each delay further aggravates the situation. Each hot box uses more strategic materials so vital to the war effort of our country. With the present design of friction journal bearing and saturated waste we can only put forth our best efforts to keep hot boxes to a minimum.

About three years ago, a committee of railroad men having J. R. Brooks, supervisor of lubrication and supplies, Chesapeake & Ohio, as chairman, made some constructive recommendations in connection with changing the dimensions of journal bearings and journal wedges. These recommended changes were to insure the journal wedge would receive all lateral thrust by contacting the box lug instead of the journal bearing. The expected result was to reduce the pinching of journal bearing lining, thus eliminating spread linings, reducing hot boxes and effecting economical operation.

One year later this committee recommended reducing the length of journal bearing and other dimensions, that would relieve the axle collar of end thrusts and excess friction.

The Railway Service and Supply Corporation recently made some tests for the Association of American Railroads, under the direction of The Special Committee on Journal Bearing Development. In these tests the committee definitely established that reducing the "C" dimension of journal bearing insures the side of the wedge instead of the bearing shall contact the lug at side of the box. These tests also indicated the "C" dimension of journal bearing could be reduced to the "N" dimension and consequently improve the rotation and lift of the journal bearing as well as the axle spread, when subjected to shocks from brake applications with weight of car body jacked from the trucks. From this test we assume there would be a similar improvement in the dislocation of journal bearing when the car is subjected to shocks from hump switching, etc. This committee also developed, considering the journal box assembly as a whole, i. e., the axle, lined bearing, wedge and box that major changes in composition and construction of the bearing can be made without materially affecting the dissipation of the frictional heat generated within the assembly.

We all know from our own experience and the years of experience of others, that hot boxes are caused from numerous things beyond the control of individual railroad's account of the interchange of each other's cars. Some of the causes are shown in the table.

Causes of Hot Boxes

Weakness of design
Waste grab
Too much packing
Improperly packed
Periodical repacking too long between repack dates
Dry packing
Extremely cold weather; extremely hot weather
Human element (man failures)
Improper viscosity of oils at different seasons of year
Abrasive or cutting particles in packing
Worn truck and bolster guides
Worn pedestals and journal boxes
Crown journal wedge worn flat
Bent axle at journal
Tapered journals
Back of journal bearing having high spots and not fitted to wedge
Improper wheel and axle work on journals
Unequal distribution of lading
Overloading

Devices to Prevent Packing from Rolling

It has been my observation and experience that some device to prevent the journal packing from rolling, or some change in the design of the journal box that will accomplish the same purpose, is vitally needed. The waste rolls to the rising side of the journal, and the first shock action of sufficient force to dislocate the journal bearing you have a waste grab and a consequent hot box. It is beyond doubt that waste grabs are causing the largest percentage of hot boxes, also a large percentage of such hot boxes occur within fifty miles from departing terminals. We learned from a recent paper by C. B. Smith, engineer of tests, Boston & Maine, that one railway was having encouraging success with a device for preventing waste grabs. Description of the device is as follows: Two pieces of wood 1 in. shorter than the length of the journal, ½ in. to ⅝ in. thick and 1¾ in. or 2 in. wide are placed from front to back of the journal on top of the waste packing. These pieces are connected to each other at their outer ends by a strip of steel baling tape, which, when bent into position in the front of the box, holds the wood strips so as to prevent the packing from rising.

The earlier trials with wood strips were not satisfactory, because the pieces were nearly the length of the box extending past the axle collar. What happened to these strips of wood was a most convincing proof of

* Abstract of a paper presented before the May, 1943, meeting of the Southern & Southwestern Railway Club at Atlanta, Ga.

† General foreman, car department, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

what transpires within the box when the heavy brake applications or severe end shocks occur. The axle collar jammed against wood strips first denting them and finally breaking some of them, and causing splinters to drop on the packing and later to work up under the brass. Some splinters were found embedded in the lining of the brass. The present shorter pieces of wood used by this railway are not contacted by the axle collar and therefore, we are told, giving satisfactory results.

The Atchison, Topeka & Santa Fe is using a device on their passenger cars, possibly for test purposes to accomplish the same results. This device is made of sheet brass formed in a semi-circle, which covers the portion of journal exposed below the journal bearing. The upper edges of the device have flanges approximately ½ in. wide, to prevent waste grabs entering under the journal bearings. The length of the device is equal to the length of the journal from base of collar to base of back fillet. To provide lubrication this device has 42 holes approximately ¾ in. in diameter, located so as to permit the journal packing to protrude and furnish oil between the brass sheet and the journal. The writer does not have any information at present as to the merits of the device, but from its design it should prevent waste grabs and the holes in the bottom of the device for lubrication should retard the rolling of packing.

There is a great potential demand for some efficient economical device that will prevent rolling of packing and waste grabs. These two evils are an evident weakness in the design of the journal box and interior parts.

In the post war period the railroads will be confronted with keen competition from air lines on both freight and passenger business, on a scale possibly beyond present expectations. Building of better highways to provide work for unemployed will bring trucks to the front in the transportation field. Therefore, if railroads are to participate in their share of the transportation business, faster speeds must be achieved, delays on line of road and in the terminals must be reduced to a minimum. Reduction of hot boxes will play an important part in attaining this goal.

Packing to Reduce Waste Grabs

Proper packing of boxes will have some bearing on reducing waste grabs. The A. A. R. method provides the use of a back roll to properly lubricate the fillet at the back of the journal and to keep out the dust; as to the body of the packing, it is required to preferably be in one piece and our attention is directed to make sure no loose ends or threads protrude at the sides or ends, being careful to see that such ends are tucked under the sides of the packing and further that no pieces of packing be laid alongside of journal as such pieces may become caught under the bearing and cause a hot box.

Another method of packing which we think goes further toward protection against loose ends and waste grabs, is to apply the entire packing in rolls 7 in. to 7½ in. long and approximately 3½ in. in diameter. The journal packer, from experience, picks up enough saturated waste to make the roll, spreads it out flat until about 12 in. wide, then rolls the packing similar to wrapping up a package, tucking in the outside edges, sufficient to reduce the length of roll to the desired amount. Care should be used to see all loose ends are tucked in and the roll is not made too tight. Usually four such rolls are required to pack a box. In applying each roll the packer uses packing paddle to keep the waste worked up firmly under the journal and down on the sides to one inch below the center of the journal.

Considerable importance is attached to the design of packing paddle, and rightly so, for if improperly designed, it is impossible to work the waste under the journal and down on the sides to the extent desired.

When the packing operation is completed a check on height of packing at sides may be determined by holding the paddle in a horizontal position, resting the end on bottom ledge of the journal box opening and pushing the paddle straight in to the rear of the box. If the end of the paddle contacts any waste, the packing is too high and should be worked down more thoroughly.

A check of a considerable number of cars on various days in a large terminal recently developed a high percentage of boxes as having too much packing. This condition prevails on cars today, notwithstanding the fact the A. A. R. insists on packing being one inch below the center line of the journal. Too much packing, in addition to causing waste grabs, has a direct effect on the running temperature of the box.

The Railway Service and Supply Company in Indianapolis have conducted tests in their laboratory which show conclusively an overpacked box will reach dangerous temperatures, particularly in the summer time, apparently caused from friction of the packing against the journal and the excess packing precluding the dissipation of the heat.

Seven and one-half to eight pounds of packing should be sufficient to repack one 5½-in. by 10-in. journal box.

The A. A. R. manual of standards covers three kinds of packing for journal boxes, namely, cotton, wool and cotton and wool mixed with certain specifications covering each type.

Tests have shown that all wool packing develops higher running temperatures than all cotton packing. It is also known that all cotton waste does not possess the resiliency common to all wool waste.

Taking into consideration that all-wool waste runs at higher temperatures and has a tendency to hold the heat and that all-cotton waste runs at lower temperatures but not possessing the necessary spring-back action, it would seem an ideal packing would be a mixture of cotton and wool waste in amounts of approximately 50 per cent each.

When the time limit for repacking journal boxes on freight cars was first established, the time limit was set to coincide with cleaning dates of K type air brakes. It was a known fact that freight-car journal boxes should be repacked periodically, but apparently insufficient data were available as to how often the work should be performed. This time limit still stands in Interchange Rule.

Shorter Periods Between Repacking Needed

Mileage made by freight cars today certainly justifies that the time limit between repacks be shortened, and if adequately reduced will have a definite bearing on the miles made per hot box.

There are numerous journal boxes in service today with the roofs of the boxes worn concave, which subjects the journal to nonuniform loading, creating excess friction and a hot box.

It is important that all wheel shops check their axle lathes to make sure journals are turned true and free of taper. Tapered journals cause unequal weight distribution and result in increased frictional heat. A tapered journal will not improve in service.

Too much emphasis cannot be put on quality of workmanship in wheel and axle shops. Periodical checks of such shops as outlined in A. A. R. circular DV-1010 and approved by letter ballot as shown in A. A. R. circular DV-1020, will help toward improving hot box mileage.

Journals put in first-class condition in the wheel shop must be protected when placed in storage. A suitable rust preventive should be applied to the journals that will not be affected by the sun, rain, or snow. The journal coating should be of a type which can be economically removed when applying the wheels to a car.

Wheel sticks should be designed to fit the axle back of the wheel and should never be applied to the polished surface of the journal or collar. The high quality of workmanship performed by the wheel shop can be spoiled in one minute by improper use of the wheel stick.

Extremely cold weather causes the moisture in the packing to freeze, the oil to congeal and the packing to roll. In some cases the packing will roll almost entirely out of the box. Such conditions result in poor lubrication and are potential waste grabs.

When the weather is extremely hot, the temperature dries out the necessary moisture in the packing. Tests have been conducted on various railroads to maintain the proper moisture content during the hot summer months. One railroad applied a gill of water to each box and was having success until the application of water got out of control.

Last year we were having some trouble with hot boxes on refrigerator cars and investigation developed the ice bunker down spouts were missing, permitting the salt brine to run in the journal box. We called the refrigerator company's attention to the matter and received prompt action from them, which corrected the conditions complained of.

Our railway is making about fifteen times the mileage per hot box delay on passenger equipment as compared with freight equipment. Passenger cars are not subjected to the shocks of terminal handling that cause waste grabs and disrupt the packing. Also periodical repacking of journal boxes is performed each six months. Passenger cars are equipped with high-speed trucks designed to absorb the vertical oscillations and lateral thrusts. Passenger cars are not interchanged to the extent common to freight cars.

How Much Does a "Hot Box" Cost?

The cost of a hot journal has been estimated to run from twenty to forty dollars and it is felt by the writer the higher figure is more accurate. Under present conditions, however, when every piece of rolling stock is needed, the cost of a hot journal is almost inestimable.

One of the factors deleterious to the advancement of design of the journal box and interior parts is the interchange rules placing the responsibility of hot boxes on the handling line. Two of the largest contributors to hot boxes are waste grabs and the present long period between repacks. The repack period can be shortened by proper procedure through the Association of American Railroads, but the waste grab problem is a weakness of design that has not kept up with the evolution of railroading in general.

If each railroad had to stand the cost of all rough journals on their equipment, I believe we would see all research laboratories get busy, and we would begin to see progress made in increased mileage per hot box. Car owners would see that a better class of workmanship was performed on their equipment, would conduct the necessary research to correct the design and eliminate waste grabs.

Placing responsibility of hot boxes on the handling line seems to be on the presumption that each railroad by proper inspection and lubrication of foreign cars can prevent all hot boxes on such cars.

Hot Boxes Should Be Owners' Responsibility

Taking into consideration the various causes of hot boxes, the limited inspection permissible at departing terminals, it would seem more reasonable to make hot boxes an owners' responsibility with certain restrictions applicable to hot boxes occurring to journals on which wheels were changed, on the same road, within certain time limits.

All railroads would continue to furnish the necessary free lubrication, using the same policy as performing similar work outlined in Interchange Rule 108.

Under present Interchange Rule 44, certain damage is recognized as owners' responsibility due to the understanding cars should be designed of sufficient strength to withstand damaging shocks in regular operation.

We as practical railroad men know every journal bearing cannot be examined in departing trains, neither would the time spent be justifiable when considering the results to be obtained. Then why block progress by penalizing the handling line.

In recent months the A. A. R. has required all railroads to make monthly reports to them as to the miles made per car set out, account of hot box, separated between system and foreign cars. During November the railroads averaged 543,948 miles per set out; in December they averaged 577,942 miles, and for January, 1943, the average was only 386,610 miles per set out. The A. A. R. explained the drop in January was due to extremely cold weather. Contrary to the average made on all roads in January, the N. C. & St. L. made the best record in its history on hot boxes.

In January we averaged on freight cars per hot box delay 576,000 miles and averaged over one and one-half million miles per set out.

Making the best hot box mileage under present conditions whether figured on the delay or set out basis depends on a number of things: Proper wheel and axle work as outlined in the Wheel and Axle Manual, proper protection of axles stored for future use, proper maintenance of trucks, adequate inspection forces and oilers at terminals, inspection of cars before departing from terminals (after being switched and placed in outbound trains), making periodic surprise checks of work performance by car inspectors and oilers as well as on repair track.

Car inspectors as well as car oilers should be required to look in all boxes and be held responsible for hot box performance. The car inspector from his general experience is better qualified to pass on the attention needed.

Supervisors should insist on the car oiler setting the packing up under the journal and working down of the packing on the side of the box. Not just mechanically poke the paddle in the box and then remove it.

Heads of the mechanical department should have someone designated to make surprise checks at each point at least once per month and should require a report to be made to his office showing the conditions found and the action taken.

How Coolants Should Be Used

To improve the miles made per car set out some roads have all cabooses equipped with hot box coolant sticks for use by train crews to prevent setting out cars on line of road when hot boxes are discovered. Printed instructions covering the use of coolant is also posted in all cabooses. These instructions in general are:

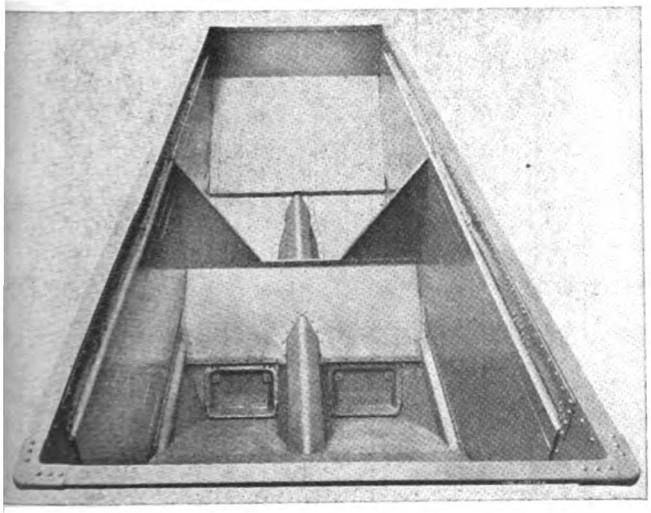
"If hot box is discovered before packing is destroyed place a stick of hot box coolant along rising side of the

(*Continued on page 406*)

Emergency Composite Hopper

Pullman-Standard now building 4,000 50-ton cars in which A.A.R. emergency design is closely followed—Wood sides and slope sheets save about 5,000 lb. of metal

A PROGRAM calling for the construction of 4,000 50-ton composite hopper cars, closely following the Association of American Railroads emergency design, is now under way at the various plants of the Pullman-Standard Car Manufacturing Company and it is anticipated that these cars will be completed and made available for service within the next two or three months. Five railroads participated in the orders for this new equipment which were duly approved by the Office of Defense Transportation and authorized by the War Production Board earlier in the year. A breakdown of the total order is as follows: 1,450 cars for the Southern, built at the Bessemer, Ala., plant; 100 cars for the Central of Georgia—Bessemer plant; 200 cars for the Santa Fe—Michigan City, Ind., plant; 1,250 cars for the Chesapeake & Ohio—750 at Michigan City and 500 at the Butler, Pa., plant; 1,000 cars for the Louisville & Nashville—Bessemer plant.



How the 50-ton composite hopper looks on the inside

The new cars are designed primarily for coal service, but will also be used for hauling slag, crushed stone and similar heavy bulk materials. For this type of equipment, railroads usually specify copper-bearing steel which is not available for freight car construction during the present emergency. Ordinary low-carbon steel plates, shapes and castings are therefore used, the steel car structures being fabricated for the most part by riveting, except the center sill which is formed in the usual manner by a longitudinal electric weld connecting two standard Z-sections.

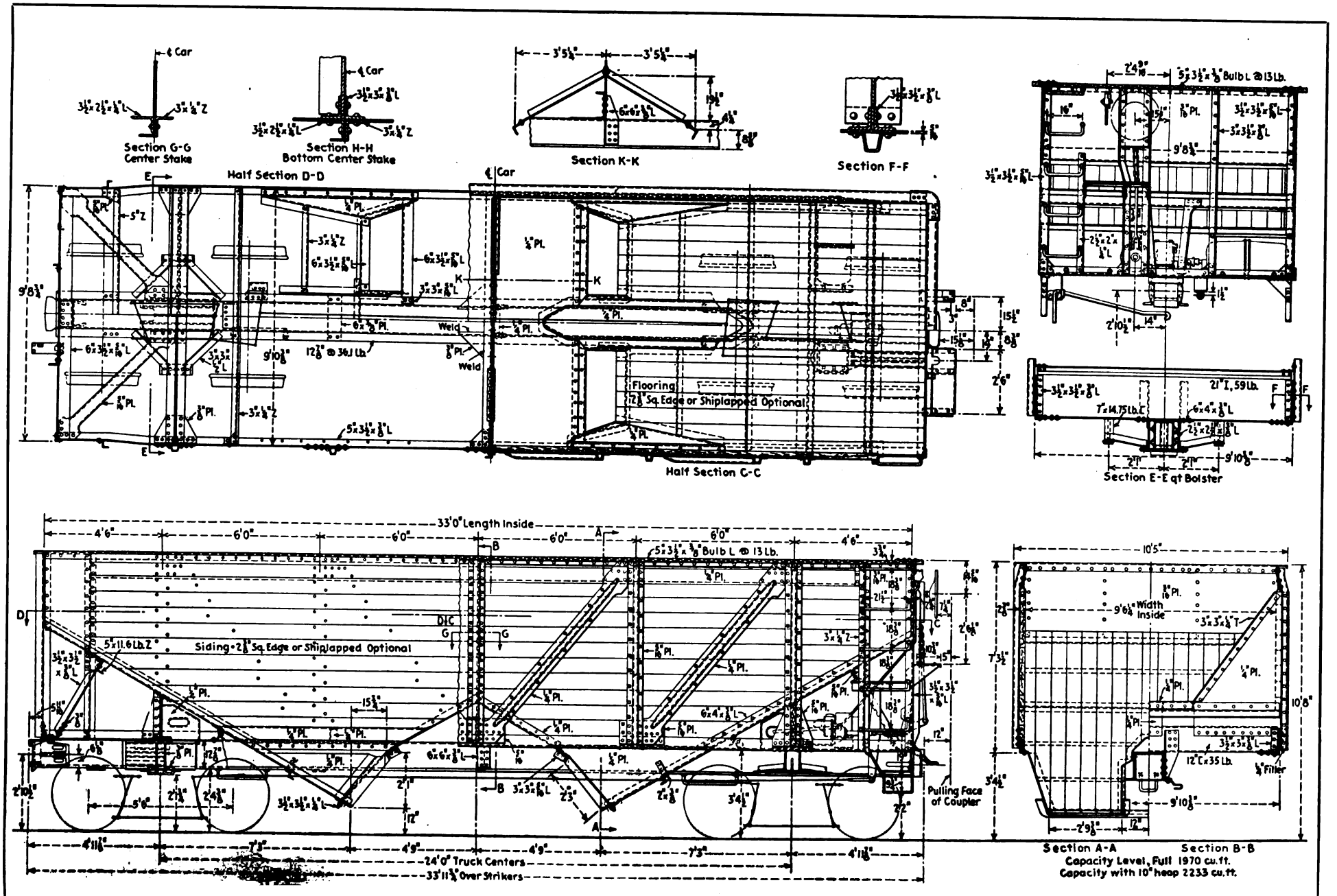
A comparison of the general dimensions and weights of one of the new 50-ton composite gondolas with an equivalent car built entirely of steel for the Illinois Central in 1941 is given in one of the tables and two superimposed side views show the differences in appearance and construction. Referring to the table, it will be seen that the reduced inside width of 9¾ in. is a major factor in reducing the cubic capacity 175 cu. ft., either level full or with a 10-in. average heap, which is a reduction of about 7 per cent. The composite car is also 5,800 lb. lighter than the all-steel car.

The impelling reason for specifying composite wood and steel construction in building these hopper cars was to save as much as possible of the steel so urgently needed for other war purposes. The 50-ton composite car, described in this article, requires about 5,050 lb. less steel than equivalent all-steel car, but utilizes 1,590 board ft. of lumber which is not needed in the all-steel car. However, in designing the A.A.R. composite car, the A.A.R. Car Construction committee and the American Railway Car Institute committee made provision for the removal of wood side planks and end floor slope sheets and the future application of steel sheets. The steel hopper is also designed to accommodate the A.A.R. door.

The grade of lumber used in the composite car depends upon the section of the country in which the cars are built and also depends, as the situation exists today, on the availability of different grades of lumber. Some of the cars are being built with B & Better fir siding and B & Better Southern pine flooring when obtainable, but in some cases it is necessary, in order to obtain the

Partial List of Materials and Equipment on 50-Ton Composite Hopper Cars for the C. & O. and the Santa Fe

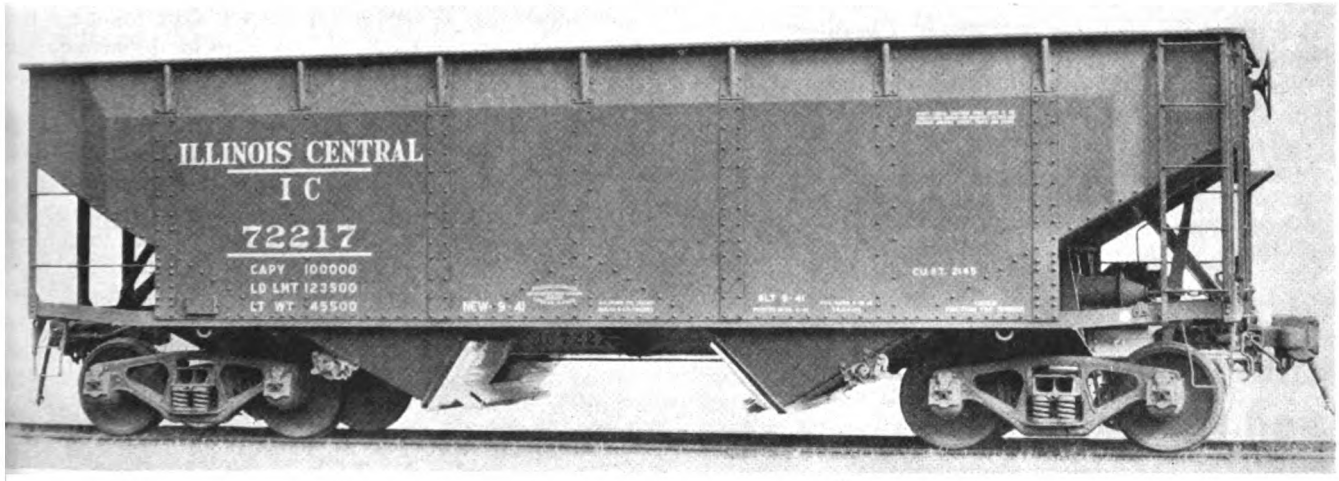
	C. & O. Hoppers	Santa Fe Hoppers
Axles	Carnegie-Illinois Steel Corp. Standard Forgings Co.	Bethlehem Steel Co.
Wheels	Griffin Wheel Company Pullman-Standard Car Mfg. Co.	Bethlehem Steel Co.
AB brakes	Westinghouse Air Brake Co.	Westinghouse Air Brake Co.
Hand brakes	Ajax Hand Brake Co.	Ajax Hand Brake Co.
Brake beams	American Steel Foundries Chicago Railway Equipment Co.	Chicago Railway Equipment Co.
Brake-beam hangers	Schaefer Equipment Co.	Schaefer Equipment Co.
Brake-beam safety supports	Chicago Railway Equipment Co.	Chicago Railway Equipment Co.
Body brake levers	Pullman-Standard Car Mfg. Co.	Schaefer Equipment Co.
Brake regulator	None	Royal Railway Improvements Corp.
Side frames	American Steel Foundries Buckeye Steel Castings Co. Scullin Steel Co. The Symington-Gould Corporation	American Steel Foundries
Journal bearings	Magnus Metal Corp.	Magnus Metal Corp.
Journal-box lids	Motor Wheel Corporation	Asco Box Lid Company
Dust guards	Consolidated Equipment Co.	Portable Plating & Equipment Co.
Couplers	Buckeye Steel Castings Co. McConway & Torley Corp. National Malleable and Steel Castings Co. Symington-Gould Corp.	Symington-Gould Corp.
Draft gears	Cardwell Westinghouse Co. National Malleable and Steel Castings Co. Peerless Mfg. Co.	National Malleable and Steel Castings Co.
Hopper-door locks	The Wine Railway Appliance Co.	The Wine Railway Appliance Co.
Defect-card holder	Motor Wheel Corporation	Apex Railway Products Co.
Lock and speed nuts	MacLean-Fogg Lock Nut Co.	Lewis Bolt & Nut Co. MacLean-Fogg Lock Nut Co.



Fifty-ton composite hopper car of A. A. R. emergency design

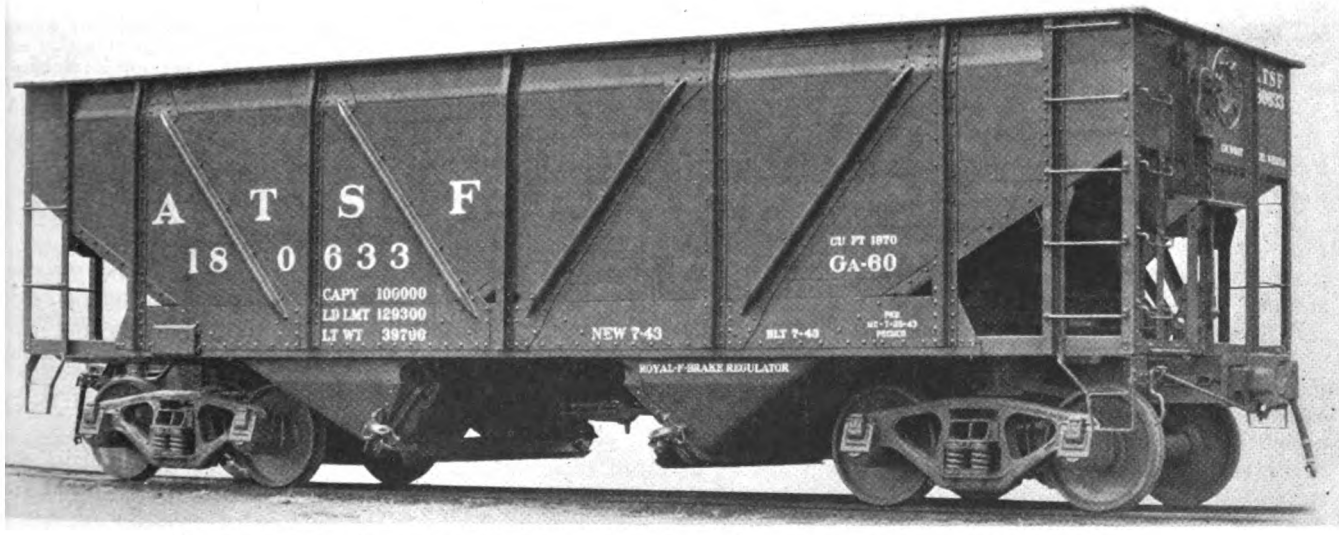


Comparative views of new composite hopper (above) and an equivalent all-steel car built in 1941 (below)



General Dimensions of 50-Ton Composite Hopper Car Compared with Those of an Equivalent All-Steel Car

	Southern composite car	I. C. all-steel car built in 1941
Inside length, ft.-in.	33—0	33—0
Inside width, ft.-in.	9—6¼	10—4
Height from top of rail to top of side plate, ft.-in.	10—8	10—8
Cubic capacity, level full, cu. ft.	1,970	2,145
Cubic capacity, 10-in. heap, cu. ft.	2,233	2,408
Light weight, lb.	39,700	45,500



Fifty-ton composite hopper, built for the Santa Fe by the Pullman-Standard Car Manufacturing Company

lumber, to use Southern pine or fir of the next lower grade.

As shown in the illustration, the sides of the 50-ton composite hopper car are of wood construction, also the flooring from the end of the car down to the beginning of the hopper bottom which is of steel. The first design, prepared by the A.A.R and the A.R.C.I. at the request of the W.P.B. had a wood floor extending from the end of the car down to the hopper door. However, a revision approved by the W.P.B. was finally obtained specifying steel bottoms for the hoppers.

While the new composite cars closely follow the design of the A.A.R. 50-ton emergency car, there are variations in a number of minor details. The most important of these is the use of an I-beam section for body bolsters instead of a built-up design using rolled plates as in the all-steel car design. The main reason for this difference in bolster construction is that, at the time the car was designed, the steel plate situation was tight and the W.P.B. requested the elimination of as many steel plates as possible and the use of rolled sections instead. As a matter of fact the inclusion of I-beam sections for the body bolsters also cuts down the steel required.

Specialties used on these cars are specified by the individual railroads in accordance with their respective standards with the exception that the W.P.B. has insisted upon using specialties on hand throughout the country previously manufactured for cars frozen by government order. Specialties used on the Santa Fe and the C. & O. hoppers are shown in a table.

Lubrication And Hot Boxes

(*Continued from page 402*)

journal, using packing iron to force same down between packing and journal. If packing has been destroyed, repack after journal has cooled and apply hot box coolant. Two sticks may be applied, one on each side of the journal.

"Before applying new brass to heated journal line same with hot box coolant so when applied there will be a substantial coating of compound between brass and journal. The heat of journal causes coolant to soften and lubricate the journal in the presence of high temperature until terminal is reached.

"Water should not be used in boxes after applying coolant."

The exceptions to the above instructions are:

"If packing is destroyed the journal is usually too hot to repack the box and a small amount of water may be used to cool the journal before applying new packing or journal bearing."

Whether a system of using hot box coolant to run cars to next terminal succeeds in increasing the miles made per car set out for hot box depends largely on the amount of business handled, type of business handled, and policy of the management.

Naturally treating hot boxes with coolant to enable the car to be moved to the next terminal will require some time, particularly if box has to be repacked and a new journal bearing applied. The frequency of trains being run on a division has a distinct bearing on the amount of time available for hot box treatment and may preclude the use of the treatment.

It may be decided in some cases that the overall delay in setting the car out, repairing, and later having another train stop and pick up the car, equals or exceeds the time which would have been required had the journal been treated with coolant and brassed when first discovered.

Under present conditions there are certain high-class freight trains and military trains which railroads would not want to delay in order to treat a hot box on a less important train. There have been and will be more cases where a hot box on a car in a military train will have to be treated to run to the next terminal, account of the commanding officer of the train refusing to grant permission to set the car out.

Considering the various factors involved, adoption of the use of hot box coolant is a matter for the management to decide, because both the mechanical and transportation department are involved.

If from investigation, the management decides on the use of hot box coolant, the mere issuance of instructions and carrying supplies will not suffice to get proper results. A suggested procedure is to require the Transportation department to wire the Mechanical department each time a car is set out on line of road for a hot box. On receipt of the wire the Mechanical department can start an investigation to develop if treatment was given before car was set out, and if not, why not, etc.

The preceding paragraphs have dealt with the friction bearing, its weaknesses, defects and maintenance. The post war period will demand higher speeds of railroad equipment to compete with other forms of transportation. Therefore it is necessary now for us to consider improvement in design of our present equipment, which will permit such speeds with a minimum of delay and economy of operation.

The change in design of the wheel and axle assembly would naturally be, to require roller bearings for all new equipment, freight cars, coaches and locomotives.

Advantages of Roller Bearings

The N. C. & St. L. does not own any coaches with roller bearings because we have not purchased any new passenger equipment in several years. It has been our privilege to observe the "Dixie Flagler," a pool train operating over our line between Chicago and Miami, and the coaches in this train are equipped with roller bearings. We do know there has not been any hot boxes with the "Flagler" on our line since inauguration of the train. This train is equipped with Hyatt roller bearings.

Last year the N. C. & St. L. purchased and secured delivery of 10 new 4-8-4 type locomotives equipped throughout with Timken roller bearings and the performance of these bearings has been beyond our expectations.

It is not the intention of the writer to endorse one type of roller bearing in preference to another, because it is understood all types now in service are doing a good job.

The Board of Investigation and Research Transportation Act of 1940, Washington, D. C., advised the Timken Roller Bearing Company that in their studies of the railroad industry they had selected roller bearings for various railroad applications as one of the most important actual or potential improvements and were interested in obtaining as much information as possible on the subject.

A report, submitted to the Board under date of August 25, 1942, indicates that the use of roller bearings on all types of railroad equipment seems to offer the railroads the largest return of any single investment and a solution to the high speeds free of delays in operation which will be required of the industry in the future.

Roundtable:

Accident Prevention

Supervision's Responsibility

The prevention of accidents among mechanical department employees in our organization is being put squarely upon the shoulders of supervisors and foremen. The former practice of just "talking" safety to these men has been broadened into a system of training and education, with a close follow-up to see that instructions, both written and verbal, are literally observed. All of this is done for the purpose of encouraging the employee in forming the habit of safety. Training is a positive thing. No one ever takes a course in how not to do something. It is always to learn how to perform a constructive, definite task.—*Robert Scott, Director of Safety, Atlantic Coast Line.*

Supervisors Need Training

After many years of experience in accident prevention work, and with a full knowledge of the splendid results obtained through organized safety work, I have come to the conclusion that if we are to make still further progress we must make some changes in our techniques or methods of selling safety. It is probably true that by means of meetings, posters, contests, pictures, etc., we have reached 65 per cent of our railroad employees; that is to say, approximately this number have made some response to our appeals for safety-mindedness, but the results up to this time are confined to this group.

Our problem, therefore, is how to reach the 35 per cent who may give us lip service, but who have not corrected a bad practice, or who will not report or correct a bad condition coming under their observation. In other words, this group has not been convinced that accidents can be avoided and I don't believe they will respond to any form of appeal. It is now our problem, and certainly the time to see what new approach to our safety educational methods we can adopt that will reach a considerable part of this 35 per cent.

It is my thought that we must make a concerted effort to train our supervisors, first, in the elements of psychology, and second, in the fundamentals of what constitutes good foremanship. Too many supervisors give only lip service to safety—they can't sell it to their men, first because they do not sincerely believe in it, and second, if they do, they don't know how to sell it.

Through our safety supervisors and inspectors we observe and correct not over 10 per cent of the unsafe practices indulged in, and it is the 90 per cent, practically all of which are observed by supervisors, that must be corrected if we are to make any substantial improvement in our casualty ratio.

There are other important matters that must be taken up, but the education of and training of our supervisors in all departments is a job large enough and has such great possibilities, that it should be given concerted thought, to the end that we create a standardized program of how best to train all supervisors in accident prevention.—*E. E. Seyfarth, Supervisor of Safety, Chicago & Western Indiana and Belt Railway of Chicago.*

Causes and Remedies

These are unusual times, which require unusual safety effort, because of the safety problems which have developed due to increased production, stepping up the pace for the older employees, and the employment of new men. According to our superintendent of safety, C. M. Bowling, "Nothing is more productive of safety than the thorough handling of all accidents to determine the cause, and the responsible party, and then taking the necessary action which in most cases requires only a letter to the party or parties responsible and pointing out to them your decision."

In addition to the personal observations of the foremen, and myself, one of the ways we eliminate the weak links in our safety program is by the use of a small report form, shown in the illustration. It is necessary for the foreman, under whom the injured employee works, to give a definite answer to: Question 5. "How could the injury have been avoided?" and Question 6. "What action has been taken to avoid a recurrence of the injury?" In this manner certain vital facts pertinent to the safety program are determined, and handled. If these two questions are not permitted to become routine, but are filled out as the result of investigation, with a view of avoiding a recurrence of the accident, many future accidents can be eliminated.

Also, in many cases, when the employee makes his report of the accident, he is asked how he could have avoided being injured and, in the future, how he will do the job to avoid a recurrence. This makes a fixed impression upon him, which is conducive to a good safety program.

A few of the means by which we try to make our safety program effective are as follows:

When a new employee enters the service, we try to arouse his interest in the Safety Rule Book. Instead of merely telling him "Here is your Safety Rule Book, read it, and know the answers when your foreman questions you," it is explained to him that a knowledge of these rules may mean the saving of his life, limb, or severe suffering, or keep him from being the cause of injury to someone else,

LOUISVILLE & NASHVILLE RAILROAD COMPANY 563-8-41

REPORT OF PERSONAL INJURY ACCIDENT

1. DIVISION OR SHOP_____ AT_____ O'CLOCK __M. ON _____ 19__

2. NAME OF PERSON INJURED_____ OCCUPATION _____ AGE __ { MARRIED OR SINGLE } _____

3. NAME OF FOREMAN DIRECTLY IN CHARGE OF EMPLOYE INJURED _____

4. HOW MUCH TIME WILL HE LOSE?_____

5. HOW COULD THE INJURY HAVE BEEN AVOIDED?_____

6. WHAT ACTION HAS BEEN TAKEN TO AVOID A RECURRENCE OF THIS INJURY? _____

7. IF INJURY DUE TO DEFECT IN EQUIPMENT DESCRIBE NATURE OF DEFECT _____

8. STATE THE NATURE AND EXTENT OF INJURY AND HOW ACCIDENT OCCURRED _____

GENERAL OR DEPARTMENT FOREMAN — SUPERINTENDENT OR MASTER MECHANIC

NOTE—THIS REPORT SHOULD BE FORWARDED TO THE SUPERVISOR OF SAFETY AND CLAIM REPRESENTATIVE WITHIN ONE WEEK AFTER AN ACCIDENT OCCURS AND SHOULD COVER ALL PERSONAL INJURIES. QUESTIONS 3 AND 4 SHOULD BE ANSWERED DEFINITELY BEFORE REPORT IS FORWARDED

i.e., the idea is to imbed within the mind of the employee, with his first impressions, that a knowledge of the safety rules is more than a duty, but that it is for the self preservation of himself and others.

When an employee is injured, his name, time and date of injury, and the type of injury, are placed on a special chart, and a daily check is made with the timekeeper, or engine crew caller, to determine whether or not he is working. If he lays off, it is immediately indicated on the chart, and I personally contact him by having him come to the office or, in more severe cases, go to his home. Much has been accomplished through this direct personal contact.

Increased production has brought with it many problems, but two of the most outstanding problems which I have observed are: It tends to cause the foreman, the keyman in any safety program, to give more time to production and less time to safety. It tends to bring about poor housekeeping. It must be kept in mind that safety comes first. The foreman must give safety its proper place in his daily program, and insist upon good housekeeping, as these two items are the important factors in the reduction of injuries.

During these times, it is only through "effort-plus" that our safety problems are going to be solved, and the loss of man-hours through injuries reduced.—*C. L. Sengel, Master Mechanic, L. & N., South Louisville, Ky.*

Posters and Reminders

It has been truly said that an accident prevention program is based on "thought" and "reminders." To get the men safety-minded can best be accomplished by an active safety committee. It has been my experience that where we have the best safety committees, we have fewer accidents. Recently we had our shop safety men write safety suggestions. These were consolidated and blueprinted as follows:

SAFETY SUGGESTIONS
BY A SAFE SHOP EMPLOYEE

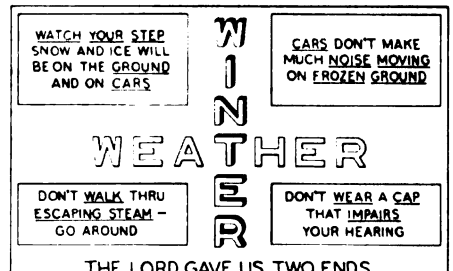
1. I shall get my proper rest.
2. I shall wear my goggles at slightest need, and call it to attention of my fellow workman if he neglects to do so. I must wear my goggles while performing the following jobs: Babbitting, chipping (all work), lathes (brass), sand blasting flues, burning, drilling (overhead), riveting, spray painting, caulking (all work), flue boring, scaling boilers, welding, grinding on emery wheels and handling acids and Oakite.
3. I shall never wear loose or baggy clothing around revolving power machinery.
4. I shall never work with defective tools, and will return them to the tool room or report them to foreman.
5. I shall never attempt to operate a machine unless instructed by the foreman or some qualified instructor.
6. I shall always wear safety shoes and keep them properly repaired.
7. I shall always endeavor to protect my fellow workmen from personal injury, as well as myself. As an example, I shall not drop tools or materials without knowing it is safe to do so.
8. I shall keep the premises on which I am working, as free of obstructions as possible.
9. I shall not operate the brakes on engines, cars or tender, without notifying employees working underneath.
10. I shall not insert fingers to determine if holes are in proper alignment for the insertion of bolts, pins and rivets.
11. I shall use an approved respirator, if necessary, when spray painting.
12. I shall report any unsafe condition to my foreman and do my work in the safest possible manner, remembering that the safe way is the right way and that the right way is the safe way.

Remember the **A B C's** for safety:

Arrive on the job with a clear head.
Be mindful of safety rules.
Concentrate on the task at hand.

* * *

The reminder part of the program is observed by special "accident prevention reminders." One of these is shown in the illustration.



Our program is not perfect; the results confirm that, and we are open to suggestions.—*A. J. Finn, Director Accident Prevention, St. Louis-San Francisco.*

The Foreman and the Worker

Reducing or eliminating accidents today is a serious and difficult matter due to the fact that numerous inexperienced men and women are employed. The right of a man to risk his life is commonly considered a part of his right to live as he likes, a fact which makes difficult any effort of his employer to keep him out of trouble at any time. Correcting unsafe acts or habits of a worker is, therefore, the secret of success in transforming a careless or inexperienced worker into a safe and efficient one. For this we must rely on supervision to accomplish results. In the shop the safety work is that of the foreman, who must have a clear understanding of the part he should play, because he must reach the individual worker, his unsafe acts, and the mechanical hazards to which the worker may be exposed, and he must take such action as may be necessary to correct them.

The foreman is the contact man between the management and the employee. Industry in general depends on its foremen for maximum production and economy and for the safety of life and limb of the worker. Acceptance of their responsibility by the foreman is essential.

In accident prevention there is and always will be exceptional opportunity for competent foremen who understand and apply responsibility of leadership. Failure on the part of the foreman to take active interest in safety work, leaving it up to the other fellow, is the attitude that will surely produce accidents and curtail production. *Preaching safety is not enough. Practicing safety is essential.*

No one, however, should expect the foreman to accomplish results in safety alone. The factor contributing to success in a safety program is the actual support and participation received from the management, as safety work is not a one-man job.

There is a cause for every accident. We then should find and remove the cause. If human, by instructions; if mechanical, by correction. Unless every part of a safety organization functions smoothly, anything is likely to happen, not only as applied to accidents but also to production in the shops, failure of equipment and consequent delays to trains.

As railroads play a vital part in the war effort, everyone connected with them should recognize their responsibility in accident prevention and in the conservation of manpower so essential now in providing safe and dependable transportation.—*W. F. Rentzel, Superintendent Safety, Southern Pacific Lines in Texas and Louisiana.*

A Safety Rule a Day

Realizing the need for better control over the actions of individual workmen, a plan was instituted on the Milwaukee Road whereby each individual foreman would discuss accident prevention matters for a period of ten minutes with the men in his charge at the beginning of each shift. Compliance with the safety rules is always stressed at these group safety meetings and as a means of having the workmen become more familiar with the requirements, a blackboard is available on which is written in chalk one safety rule each day. The men are encouraged to become familiar with the rules by this means, in addition to having their individual rule book for study. Bringing the foreman closer to the men under his jurisdiction and bringing the men closer to the foreman through these meetings has had a very beneficial effect.

In addition there are safety committees composed of men selected by vote of the workmen in the several crafts and monthly meetings are held with the supervisors and the safety committee. At these meet-

ngs there is a review of the activity in he previous month and plans are laid for he ensuing month. They accomplish a lefinite purpose.

Throughout each work shift, the fore-nen frequently find occasion to caution ertain workmen about the manner in vhich the work is being handled and the afety committee men are always on the lert to observe any unsafe practices and o immediately caution the workman.

Visiting as many points as possible and is often as possible, and invariably attend-ng the regular monthly meeting, the dis-rict safety engineer, through personal con-act with the foremen and individual work-nen, has accomplished a great deal toward mproving the safety performance.—*L. J. Benson, Asst. to Chief Operating Officer, C. M. St. P. & P.*

Accident Prevention On New York Central

On the New York Central System we have what is known as an "Accident Prevention Program," which is printed and distributed to all officers as well as those in a super-visory capacity, not with any thought that they do not appreciate their individual re-sponsibilities, but so that they will have before them something concrete to govern their activities, which are outlined some-what as follows:

Our first concern is to take such action as will *prevent* accidents and personal in-juries. This can be done through (a) edu-cation; (b) enforcement of rules.

1. *Supervision* shall be required to es-tablish a program whereby it will at frequent intervals contact each individual employee under its jurisdiction, for the purpose of impressing them as to the necessity of performing the work safely in accordance with the rules.

2. *Supervision* shall be required to check the performance of the men and see that they are following the safe method and adhering to the rules.

3. *Supervision* shall be required—where unsafe practices or rule violations are ob-served—to take necessary action so that they will be corrected.

4. *Departmental heads* will see that the foregoing procedure is followed and made permanent.

5. *Investigations*—Prompt and thorough investigations of accidents shall be made by the supervisor directly in charge and, where necessary, by the divisional officer.

6. *Discipline*—It is the obligation of those in charge of supervision to be on the alert for the detection of rule viola-tions and other unsafe practices before the accident occurs. Where such violations are discovered, appropriate disciplinary action shall be taken.

* * *

Like any other activity the degree of effort upon the part of supervisory officers in the prevention of accidents is not uni-form, and as a consequence there is a variation in the results obtained. General-ly speaking, in the shops, engine houses and repair points in both the motive power and rolling stock departments the general foremen hold safety meetings each week, with men from each department who are generally selected by the chairman of the various shop crafts. At such meetings they are given an opportunity to express their opinion relative to safety practices and offer their recommendations. Reports of such meetings are furnished the heads of the respective departments, so they may take the necessary corrective action.

Once each month the superintendent of the shop—or some other similar officer in other locations—conducts a safety meeting attended by all of his supervisory forces, as well as the chairman of each shop craft. Every possible effort is made to see that all items reported which are in need of correction are handled promptly.

Where personal injuries are involved, regardless of how slight—whether any time is lost or not—they are regarded as po-tential serious injuries. Complete investi-gations are made so that the causes may be ascertained and appropriate remedies applied. When an employee is injured, he is asked when and by whom he was last talked to regarding safety, and what was said. In this way there is a further check on the activities of the supervision.

In certain instances safety captains have been appointed each month who co-operate with those in a supervisory capacity for the purpose of detecting rule violations—not for the purpose of inflicting punish-ment; but rather for the purpose of pre-venting personal injuries. In some in-stances we have had what are known as "control boards" made up of members of the various crafts, whose duties require them likewise to be on the alert for the discovery of unsafe practices or unsafe conditions. Where unsafe practices are discovered, this board determines the ac-tion to be taken with respect to the of-fender.

The "safety rule of the day" is posted on the bulletin boards, where the attention of all employees is directed to it. Under-standable and appropriate statistics are fur-nished monthly to indicate the accident rating of the respective shops, engine-houses, repair points, etc. In addition, bulletins showing the type of accident in-volved, as well as the remedy, are posted for their educational advantage.

We consider education the outstanding fundamental of accident prevention. As a consequence, we have printed material as well as oral education. The latter is con-ducted in such manner that employees on duty throughout the full 24-hour period are contacted by a representative of the safety department.

As a result of the war, emphasis has been placed upon the necessity of con-serving manpower. We have in the armed forces approximately 22,000 employees, and in nearly all instances they have members of their own families in the service of the railroad, who now have an additional obli-gation—that of maintaining the home front. A recent bulletin making reference to this feature, among other things, contained the following:

"We are passing through trying times, and you are implored to increase your vigilance to safeguard the safety of your-self and that of your fellow employees, which can be done by *keeping your mind on the job at hand.*

"You cannot help your or the other fel-low's boy in the service if you are unable to work, due to injury.

"These boys need material which the locomotives and cars you are repairing are moving. Man-hours are ammunition. Let's not waste them.

"Ammunition wasted does not win wars.

"Man-hours wasted never return.

"These boys are depending on you for this material—perhaps their lives."

We are not unmindful of the fact that as a result of the war we have additional problems, such as labor turn-over and new and inexperienced employees. Our position has been and will continue to be that this is merely another problem and one that we *can and must solve.—Charles E. Hill, General Safety Agent, New York Central System.*

Safety Clinics

Every five minutes somebody somewhere in this country is being killed by accident. Informed people know that accidents don't just happen. There is always a cause. Someone is to blame either for what he did or for what he failed to do.

Experience has proved that "indifference" is the contributing factor to the majority of accidents that occur in our plant —indifference to safety rules or indifference to safety supervision.

A great responsibility for accident prevention rests with supervisory officers and the foremen individually and collectively. These men must know all safety rules and they must exercise a degree of supervision that will insure the men under them being familiar with and complying with the safety rules. When supervisory officers and subordinates are indifferent to their individual responsibility for safety supervision, accident prevention is retarded. Therefore, it would seem that accident prevention boils down to "personal interest" and "safety education."

In support of the above statement I might add that a few years ago our plant ranked high in eye casualties. Supervision with reference to the use of goggles was stressed. This responsibility was assumed collectively and individually by all supervisors and foremen with the result that the employees became so conscious of eye safety and eye protection that eye injuries are now practically unknown in this plant.

We believe that the best way to create personal interest in safety education is through personal contact and individual approach, encouraging the employees to accept their individual share of responsibility for their own safety and the safety of their fellow workman. To this end we have developed what might be termed a "Safety Clinic" devoted entirely to the

analysis of accident causes and prevention, and self-examination. We call this clinic a shop safety meeting. It is held each month on all three shifts and we have found it an effective means for developing safety consciousness and stimulating personal interest of the employees and the supervisors in accident prevention.

Progress on the road to accident prevention means eternal vigilance.—*H. Feather, Master Mechanic, L. & N., Corbin, Ky.*

A Problem of Salesmanship

One of the best methods to prevent accidents is the use of, and the following up of good salesmanship practices. Before a man is employed, his employer should explain to him in detail that he is to practice safety and to obey all the safety rules, and when he goes into the service his foreman or leadman should continue to educate him so that he might benefit from safety, as well as the employer or the employing company.

Any laxity on the part of the organiation, the supervisors or the safety leaders, will result in accidents and careless practices. If men are sold on safety and taught to discontinue unsafe practices, it will improve our safety record.—*W. E. Hunter, Master Mechanic, L. & N., Covington, Ky.*

Foremen Are Key Men

Each week a safety meeting is held with each group or gang, the supervisors acting as chairmen. Each one present is allowed to express freely his opinion as to how injuries can be prevented, and the injuries that have occurred since the last meeting are discussed, developing how the accident happened, why it happened, and who or what was responsible for it. Many good suggestions are brought forth and this method of group safety meetings makes it possible for each man to be contacted in connection with the prevention of injuries.

In addition to these group safety meetings, a meeting is held with each group or gang of men before their tour of duty, the supervisors conducting the meeting. At these meetings, safety rules are read, injuries are discussed that have occurred within the last 24 hours, enlightening those present as to steps to be taken to prevent like injuries. To create interest, various employees participate by reading the rules out of the rule book and make suggestions as concerns unsafe practices and conditions.

When one of our employees is injured, a thorough investigation is made as to how the injury occurred and who or what was responsible for the injury; what steps were taken prior to the injury and what was done after the injury occurred to prevent recurrence.

When the party or parties responsible are determined, all concerned are written, being advised of their responsibility and the manner in which they are responsible. This is placed in their personal files for future reference as employees who indulge in unsafe practices are subject to discipline.

A report of all minor injuries is made and in this report we do not permit the word "cautioned" to be used as we feel the men should be *properly instructed* instead of *cautioned*. The highest ranking officer, which is the master mechanic in this case, reviews these reports, issuing suitable instructions wherever he finds it necessary.

Under the guidance of the safety department and the safety inspector of this district, we develop from time to time, means and ways of preventing our employees from being injured. We find it a very good practice for the safety inspector to discuss injuries, informally, with the men, securing from them their views as to how the work of safety first can be furthered. We have tried many methods of improving and perfecting the safety program and we believe our present practice is more effective than other methods used or tried in the past.

Many new employees are entering the service. Employment officers should be very careful to select only those that are suitable to the service or the work to which they will be assigned, as many men and women can be termed as "accident prone." It is highly important, therefore, that new employees be instructed and taught how to perform their work without suffering injury to themselves or causing injury to their fellow workmen.

It is our opinion that the supervisors or foremen are the key men in the prevention of injuries to the workers under their charge and for this reason, we hold them responsible for the men they supervise as they are better informed than others who may attempt to handle such matters; therefore, our supervisors are required to instruct and teach each new employee not only how to do his job well, but how to do it safely, as we feel that the highest degree of efficiency is attained when a job has been performed in a workmanlike manner, in the shortest possible time, and without injury to the employee engaged in the work.—*C. A. Ellner, Master Mechanic, L. & N., Nashville, Tenn.*

Safety Is Not Cheap!

Injury prevention in the mechanical department, or for that matter any other department on a railroad, is right up to management. Like everything else, you get just what you put into it—no more, no less.

The comparatively few railroads with outstanding injury prevention records are simply reaping the results of a farsighted policy of providing adequate safety organizations that have, in a long period of time, effectively trained supervisors in the fundamental principles of safety and good housekeeping, instilled into each and every employee the desire not only to do his work in a safe and careful manner, but to keep an eye on his fellow employees as well. To do this costs money. It would be interesting to compare the expenditure made for the cause of safety by some of our large modern industrial concerns, and the railroad industry generally. This would probably explain why the railroads the pioneers in the safety movement in this country, are left so far behind in obtaining results.

Supervisors in the mechanical departments have been hard-pressed in recent years. First it was the depression, when expenses had to be cut to the bone; now it's the War. They are busy men, extremely busy. Their jobs are trying and nerve-racking. War demands must be met; engines made ready for waiting trains; cars repaired to meet daily demands. They are contending with inexperienced men and a labor shortage. There is not enough experienced help and they are too busy to watch green men.

Under these conditions, active safety is apt to be sidetracked for the duration.

Not so, however, where a good ground work of injury prevention has been previously thoroughly laid and instilled into each supervisor and his key men. On these railroads a good record is being maintained regardless of the present unusual conditions.

Safety, like every other worthwhile thing, must be bought and paid for. It is not cheap—there are no bargains, but it's worth the price.—*Frank Cizek, Supt. Safety, D. L. & W.*

Safety Begins With Order

Nothing we have done in our shops has improved our safety performance so much as the insistence by our chief mechanical officer on order. We believe that most of our shop injuries can be prevented by orderly work. That means order in its larger sense, beginning with orderly physical conditions on the floor and ending with orderly thinking, planning and working clear through to the newest employee.

Ups and downs of prosperity seriously upset attempted long range planning and railroad shops are no exception; however, standards of orderliness carry through very effectively once they are thoroughly established. Order began with us in cleaning up our shop floors getting rid of scrap; cleaning corners, benches, lockers, etc.; painting machines; keeping clean windows; using light interior paint; defining aisles; maintaining footways about engines undergoing repairs, and orderly piling or placing of material when delivered.

The second phase of order has been noticeable in the habits of the personnel. Orderly conditions are a managerial job but they produce orderly work. Our men are quick to call attention to any disorderly condition now which they once would tolerate in silence. Thus orderly surroundings stimulate more orderly habits that the men insist must be followed.

The third beneficial effect of an orderly shop is improved straight or orderly thinking in the whole shop organization. Another name is self-discipline and to my mind this is the most important fruit of orderliness resulting in improved safety. It is a necessary prelude to becoming safety conscious. It is the recognition by the individual of his own responsibility for and the stimulation of pride in his safe shop.

We are thoroughly sold on the value of informal five-or-ten-minute group safety meetings held weekly right on the job. They do wonders in maintaining orderly conditions and work. We have not attained perfection, of course, but improvement directly traceable to order in the shop is everywhere noticeable and one of our blacksmith shops working 35 to 40 men on this August 10 proudly displays a clear injury record of 2,420 days. That record started with an orderly shop.—*F. W. Curtis, Supt. Safety and Fire Prevention, D. & R. G. W.*

Fighting With Dull Razors

While it is true that the steam railroads were leaders in starting the safety first movement some thirty years ago and since that time have continued to carry on effective accident prevention programs, it is possible that some departments of some of the railroads have reached the point where the epitaph on the headstone in the country cemetery adjacent to a small colored church, is applicable. As I recall this epitaph, it read "He fought a good fight but his razor was dull." During the long period that the accident prevention program has been carried on, it is possible that we have allowed the edge of our enthusiasm to become dull and because of that, the program has not been fully effective.

The cause of most personal injuries to railroad employees, including those in the mechanical department, is lack of thought and the cause of this thoughtlessness, is lack of interest. Just who is responsible for this lack of interest might well be and probably is, a controversial subject. Personal injuries are man failures, the same as the improper inspection of or repairs to equipment are man failures and for the latter, supervision has always been held accountable and properly so. It is my opinion, which is shared by a great many others, that supervision should also be held responsible for personal injury accident failures. These failures in supervision might be on the part of the injured employee's immediate gang leader or foreman, or it might reach considerably higher into the official family.

If a department head fails to show an interest in the prevention of injuries to the employees in his department, it can hardly be expected that his division and shop officers, their general foremen and other supervision, will be interested. Most railroad people who continue to serve in any capacity, do what the "boss" wants them to do regardless of what such superior officer's title or position is in the company. If the "boss" is keenly interested in the prevention of personal injuries, that interest goes a long ways in making a satisfactory accident record.

The difficulty seems to be that in these extremely critical times, with the railroads carrying an unusually heavy load of traffic, with labor shortages despite taking into service a large number of young and inexperienced employees, some men in supervisory capacities have been so busy with the repairs and inspections of equipment, that they have let their interest in the prevention of accidents lag. In all fairness to most supervision on this railroad, that is not true. It is true that our mechanical department accident record is somewhat spotty, the same as the mechanical accident records of the various railroads are spotty, and there is considerable room for improvement in the overall picture, but where the accident record is bad, the interest is also insufficient.

Safety officers are not without responsibility in the present emergency. Possibly we have allowed the edge of our efficiency to become dull. Possibly we have used present-day conditions, the large number of new and inexperienced employees, and the tremendous increase in business, as an alibi when personal injuries increased. Possibly we have not been as energetic as we might have been in helping mechanical officers to sell safety to their supervision. If we have not failed in any of these things it is still possible that we may have failed in calling to the attention of shop and division officers, laxities in their own supervisory forces or have failed to call attention of department heads, to a lack of interest on the part of the shop and division officers. The job of a safety officer and members of his staff, as I view it, is one of selling safety education to those who are in the official and supervisory family so they in turn can educate the men under their supervision.

There is one appeal which I do not feel has been so generally used by railroad safety officers as it has been in other industries and that is, the appeal of patriotism in this war time emergency period. I believe that this is due to the fact that early in the history of the safety movement the emotional appeal was overdone. It is unfortunate that the safety movement was started at a time when many so-called welfare plans were put into effect, most of which have disappeared because they had no practical economic background. The safety program endured because it had this economic background and many of us who have been in this field for a long time, hesitate to again get into the emotional field because of the difficulty we previously had proving that accident prevention activities were not only good "humanics" but good "economics" as well.

To summarize—It is my feeling that any increases in personal injury accidents which are occurring in some units of our mechanical departments are due to the lack of effort to maintain interest in those units where the increases are occurring. The responsibility for this lack of interest rests with those in mechanical supervisory, and safety educational positions. In evaluating this responsibility it is well to keep in mind that the safety department has no authority over the employees of other departments and that the control of the work of those in the mechanical departments, rests (and properly so) with the officers and supervisors of that department.—*J. E. Long, Supt. Safety, D. & H. (Former president, National Safety Council).*

Active and Constant Supervision Necessary

For many years, it has been recognized generally by employing and supervisory officers that a good employee must be alert, intelligent and active, physically and mentally, and when possessing such qualifications, he usually develops into a productive and safe employee. In line with such conclusions, many railroads—some more than others—have put forth real effort for a number of years to employ only the highest type of alert, intelligent men, with responsive reflex actions. By so doing, the personnel was gradually improved, not only from a productive standpoint, but also from a safe-worker, or safety, standpoint.

In the past few years, railroads have been faced with a situation, where available manpower did not permit of the desired selection of employees. As a result, many men, and even women, have been employed in practically all departments, who in former years would not have been taken into the service, regardless of the "kinsfolk" pressure frequently brought to bear by employees now in service to secure employment for one of their relatives, regardless of his apparent inability to perform work properly and safely.

Now, that many "below-par" employees have been employed, railroads are faced squarely with the problem as to what should be done? First, all officers and supervisors must realize definitely that it is necessary to do the best that can be done under existing circumstances. Recognizing this fact, in event clear, concise and practial safety rules are not in effect, such rules should be revised, or new and comprehensive safety rules adopted without delay. All employees must be thoroughly instructed as to the meaning of the safety rules, and then their observance constantly supervised. Particular consideration must be given new employees, many young and inexperienced, and others older in years, without previous railroad experience, who by reason of previous experience in other less hazardous occupations, do not grasp the need of observing safety rules and avoiding unsafe practices.

"Eternal vigilance" must be the watchword for the guidance of all mechanical and safety supervisors and officers. To accomplish the desired results, no supervisor or officer can relax his utmost efforts for a single instant, thereby permitting a safety rule to be violated, or any work performed in a hazardous manner, without

calling attention of the employee at fault to the rule violation or the unsafe manner in which the work is about to be, or is being, done. The violator should be cautioned, reprimanded or even disciplined, as the circumstances may require, but in most instances, when the employee at fault has his attention called to the violation or unsafe practice, he will respond willingly, after realizing the supervisors and officers are really interested in safety.

Whenever a supervisor or officer "winks" at a rule violation, or seemingly does not recognize an unsafe practice, without taking action promptly, such supervisor or officer loses his real worth as a supervisor or officer, and does not warrant further advancement and responsibility.

Therefore, now and for many, many years to come, all supervisors and officers must realize that intermittent or spasmodic enforcement of rules, and the prevention of unsafe practices, will not "get the job done." They must recognize fully the urgent need of and practice A. B. C. Supervision—Active, Better and Constant—and act accordingly.—*L. E. Hoffman, Inspector of Operation, St. Louis Southwestern.*

Must Overcome Carelessness

Many employees are injured because of carelessness on the part of others. A trap is set that the other fellow falls into. This is especially due to the mishandling of tools; tools being left on the ground in the roundhouse, back shop, etc., where employees may step on them and be injured; tools left on the running board, top of boilers or top of engine cab, which may fall off and strike men on the ground.

It is therefore my recommendation that employees be instructed to be more careful, or return the tools to the tool room, or place them in a position where they will not cause personal injuries.

Education in safety work is really about the only way that such a practice can be eliminated. Frequent talks by the foremen who are in direct charge of the different gangs, and a follow-up program in the form of a monthly safety meeting to be attended by all employees, will bring about the desired results, as I see it.—*S. S. Talbert, Master Mechanic, L. & N., Mobile, Ala.*

Train Employees To React Automatically

In my opinion, the supreme end of the safety movement is to bring each employee to a constant realization of the possibility of injury and to so train his sub-conscious mind that he will automatically take the safe course in performing any task. Most accidents are due to failure on the part of men to *think* and we must train them along this vital line. There are various and sundry ways of achieving this end. A few are listed in their relative importance:

First—A definite set of safety rules should be set up by the management, with a copy given each man entering the service. The immediate supervisor should be made responsible for seeing that all men are issued safety rules books and duly familiarize themselves with the prescribed and safe manner of doing their work. Through regularly scheduled safety meetings and by other contacts from day to day the supervisory forces can wisely direct men along this line.

Second—Men should be impressed with the fact that safety is an instrument for *helping them*, not a "bugbear" to bring criticism to the unfortunate victim of accident but, rather, to assist in preventing his being hurt again and, at the same time, by using his injury as an object lesson, to prevent similar injuries to others. It is perfectly human for anyone to respond to an interest *in him* and, once convinced that one who investigates injuries is making an honest attempt to be helpful, men are usually ready to cooperate in every respect with the safety movement. Any criticism offered should be constructive. A first offender should be cited to the rule he has violated which has resulted in his injury, and in every case a cooperative, rather than a critical attitude should be employed. By attaining the confidence of your men in this manner you have taken a long stride toward a good record. If familiarity with the safety rules has taught a man to think, then this second step has taught him to think in terms of appreciation for his company's effort to protect him.

Third—Men can be trained to think by having regularly scheduled safety meetings where employees are encouraged to report unsafe conditions about the shops, or unsafe habits noted among their fellow workers. These reports in connection with violation of safety rules should never be allowed to become personal and their handling in the group meetings should be general and from a standpoint of constructive criticism rather than individual censure. If reports persist of some particular employee having repeatedly violated the safety rules, his case should be given personal handling by his supervisor in a spirit of mutual helpfulness.

Concerning reports made of unsafe conditions, these should be corrected immediately. By giving prompt attention to reported unsafe conditions about the premises, management can impress the employee with its willingness to "meet him half-way."

I am convinced that any body of workmen who are sure their superior officials are endeavoring to protect them and are willing to give them every cooperation toward this end, will respond readily to such leadership.—*John R. Rose, Sec., Ravenna, Ky., Shops Safety Committee, L. & N.*

Harmful Bacteria—Fire Risks

We have found harmful bacteria in four out of six samples of cutting compound in use on turret lathes and bolt threaders. This compound has been dumped out and on advice of the chief surgeon, a high flash solvent has been used to cleanse the machines. The floor and surroundings are treated with a caustic solution.

A safety officer reports that gasoline has been discontinued for cleaning side rods, metal surfaces to be painted and all other cleaning purposes. In the place of gasoline this line will henceforth use a standard solvent.—*Safety Officer.*

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How Can They Be Prevented?

Excellent progress has been made over the years in the prevention of locomotive boiler failures, but much still remains to be done in that respect. Such failures are usually costly in life, limb and property and they frequently delay traffic seriously. They are especially distressing now that every man and every locomotive counts for so much in fulfilling our war transportation requirements. Just what can be done to guard against and prevent low water in the boiler and resulting boiler failures? What kind of training will assure correct procedure on the part of the engine crew to prevent disaster when a case of low water develops? This is the topic for the roundtable in our October issue. Your letter should reach our New York office as promptly as possible, and not later than September 15.

EDITORIALS

The Machine No Better Than Its Accessories

A recent editorial in these columns called attention to certain instances, none the less undesirable though possibly infrequent, in which either carelessness or lack of knowledge on the part of machine operators resulted in the misuse, serious damage and loss of production of badly-needed shop machinery. The same careful attention required by shop machine equipment should obviously be extended to the jigs, fixtures and cutting tools used with individual machines. The jigs and fixtures usually serve more or less as labor and time-saving devices for holding the work securely and expediting its adjustment during various machining operations. The importance of keeping these jigs and fixtures in sufficiently good mechanical condition to function as intended is therefore apparent.

The capacity of modern high-speed cutting tools of various types to increase production from machines with which they are used is also absolutely dependent upon a knowledge of their respective limitations and how to use them under conditions which will produce the desired results. One thing which every railway shop should be equipped and organized to do is to follow the correct procedure in resharpening these metal-cutting tools. As pointed out in an engineering bulletin on tool-sharpening techniques, recently issued by the National Twist Drill & Tool Company, today's conditions make it more important than ever before that tool sharpening be given careful and continued attention, due not only to the resultant effect upon quality and cost of production, but owing to the urgent need of conserving critical tool materials.

The first requirement in the proper conditioning of cutting tools, and one not found in every railway shop, is tool grinders and sharpening machines of the correct design, with sufficient rigidity and with close-fitting wheel spindles and slides. It is clear that the tool grinder operator must have exact information regarding clearance angles, rake angles and contours to be reproduced on the tools, this information being checked from time to time with foremen and operators to make sure that unusual requirements due to special materials or other conditions peculiar to individual jobs are clearly understood.

The importance of maintaining true, keen and well-finished cutting edges on tools can hardly be overestimated, due to the decreased power requirements, increase in tool life, also the maintenance of high-quality finish, where necessary, and dimensional accuracy. All the average man has to do is consider the difference between shaving himself with a dull razor and later with a sharp one to realize what a vast difference a smooth, keen cutting edge can make.

All competent tool supervisors and operators understand, but it will do no harm to re-emphasize, that fine-grain grinding wheels of the proper grade are required to produce well-finished, keen cutting edges and enough time must be taken to do the job without overheating. Burned cuting edges caused by the use of wheels which are too hard, glazed wheels, or excessive pressures in attempting to speed up the grinding operation, are highly detrimental to tool life, causing invisible surface cracks which weaken the cutting edges and result in premature dulling, chipping and breakage. A good workman is known by the kind of tools he uses and the condition in which he keeps them. The same may be said for the managements and tool supervisors of those railway shops and enginehouses which desire to be classed among the most progressive and efficient.

The Wand Won't Always Work

Notwithstanding the many difficulties which have surrounded the procurement of sufficient materials to take care of repairs, there apparently have been few, if any, cases of serious delay in returning cars and locomotives to service which have been undergoing repairs. Such delays as have occurred have never become cumulative to a point where they have seriously jeopardized the adequacy of service.

While materials have been difficult to secure in as large quantities as most mechanical-department officers consider satisfactory, some of the deficiency has been balanced by the reductions in stores stocks; some by extending the scope of reclamation operations (trading of labor for material) and some by deferring maintenance where postponing full normal repairs would not jeopardize either safety or essential serviceability of the equipment. To a very large extent, both with respect to locomotives and freight cars, betterments have been discontinued and specialized program repairs of freight cars generally have been discontinued.

To these measures undoubtedly can be attributed, in part at least, the ability of the railroads to maintain the extremely low percentage of bad-order cars which has prevailed since last Fall.

All of these measures have represented a taking up of slack. Once the slack has been taken up, the continued maintenance of the same degree of serviceability of cars and locomotives will inevitably require an increase in the amounts of materials which have to be procured and in the amount of work which will have to be done on them. Most of it has now been taken up; surplus stores stocks cannot be depended upon to balance the deficits between procurement and use. While deferred maintenance has not been accumulating at a sufficiently rapid rate to have yet reached the ultimate day of reckoning, taking altogether, it would seem that the quantities of materials required for maintaining equipment serviceability at present levels will soon gradually increase.

There remains little opportunity to increase the number of serviceable cars and locomotives by reducing the number out of service for repairs. Any further increase in the supply of serviceable equipment must depend upon an increase in the number of cars and locomotives owned.

WPB must not become complacent because the railways have repeatedly broken records of equipment utilization. Taking up slack is, after all, no miracle and can not be called upon repeatedly by the waving of a wand.

Out of the Frying Pan—

No doubt many railroad men who read this page have also, like the writer of this comment, read Jack Belden's "Retreat with Stillwell." Those who have could hardly fail to be impressed with the hardships that were suffered by the armies of the British, Chinese and Americans as they lost ground, day by day, in their backward move out of Burma. While the failure of the inadequate Burmese railways probably played no major part in the loss of territory in that campaign, no railroad man could help but be conscious of the vital importance of railroad transportation in the conduct of military operations.

As one reads such books as this it is difficult to keep from thinking of the fact that to us here these stories of the hardships of men in foreign lands seem somewhat unreal and, like the writings of the pulp-magazine authors, are not to be taken too seriously but rather be looked upon as a means of entertainment. It was somewhat of a shock, therefore, when the mailman brought us a letter from a friend who is in a foreign land with one of the American army's railway battalions helping to move the supplies that are needed to speed the day of victory. Among the many interesting things that he told about were a few that not only gave one an idea that railroading in the war zones was not exactly a bed of roses. For example: "We average about one serious wreck a week and constantly have trains raided by bandit tribes—just like the old wild west. Most of our engine crews never saw a locomotive before arriving here. These trains operate over heavy grades and curves without lights and many times with brakes that may or may not work. It's not a bit unusual to have to clear the line for 25 or 30 miles to let a train run down and on several occasions we haven't been able to clear, as we run on a train order system. I have seen some of the most beautiful wrecks you can imagine and have been in four myself. A good sensible, experienced hoghead wouldn't have a chance here. The temperature here yesterday was 137 degrees and that isn't the hottest weather we've had. It does cool down at night though—to around 110 deg.—and when the sand doesn't blow we can get fairly comfortable because the heat kills the flies and mosquitoes. Just think! I might have been in a nice, comfortable, safe submarine." —There's nothing unreal to us about the conditions that that railroader is writing about, for he's a chap we used to eat lunch with.

The things these fellows are doing provide a violent contrast to what some of us at home too readily call a "bad situation." It might be well to keep in mind what some of your fellow railroaders are putting up with in the far corners of the world "to help suffering humanity gain the four freedoms" and then remember, the next time you feel like growling because the dispatcher calls for "three more 2900's at nine o'clock," that at least there won't be any bandits taking a shot at you on your way home and it probably will be a little cooler than 110 after the sun goes down. Keeping this in mind may help make things run a little smoother tomorrow.

Permanent Substitutes

Pressed by all manner of war-time restrictions, it is the natural tendency for a man to do the best he can within these limitations, keep his head down and stay out of trouble. But the soldier who hides in a cave is pretty apt to starve to death or be bombed out by the enemy. Among our railroad men there are at least a few bold spirits who just will not take it lying down. The results frequently are departures from usual procedure which may permanently affect and improve railroad practices.

One example of this is a simplified explosion-proof control described in the electrical section of this issue. Confronted with the need for such a control, the engineer, instead of waiting until one might be obtained, set to work to find another way of operating the motor. He discovered that explosion-proof contactors and push-button control stations could be had and proceeded to design a variable-speed control using these devices. When finished, it met all the safety requirements, and although it provided only four speeds in each direction,

this was sufficient to meet requirements. Perhaps the best part of the accomplishment was that the new control cost less than $300, while a new controller costs about $1,500.

One of the few good things coming out of a war is that it causes us to revalue many things we have long accepted as necessities. It destroys false standards, and thanks to those who have the courage and ingenuity, it introduces new practices for bettering railroad service.

Time to Look Ahead

The recent announcement of the Department of Labor predicting post-war unemployment for between seven and twelve million people is certain to have an effect upon the thinking of those now employed in war industries and those in industries whose activities and pay rolls have been expanded because of war conditions. Certainly the railroads fall in this latter group and it is not too early for them to begin to think in terms of post-war employment needs. As a continuing business they are likely to find that the promise of a return to previous employment for every man discharged from the armed services will conflict seriously with the operation of the seniority rules generally prevailing in their labor agreements. There is no intention here to question the desirability of returning every service man to gainful civilian employment; the manner in which this is to be done is what causes concern.

In railroad shops, problems are presented which will require the utmost in cooperation between managements and the craft organizations with which they deal. Many helpers will have accumulated enough time as mechanics to be entitled to rating on the mechanics' roster; many former laborers will have either helper or mechanic status because of time spent in those work classifications. Many in all groups will have accumulated seniority time which exceeds that of men drafted, who nevertheless, have been promised work when they return.

Many railroads are considering plans which call for large equipment purchase and building programs for the post-war period when materials again will be freely available. Some are considering the modernization of rolling stock and motive power and catching up on deferred maintenance. While the map of the future is not yet filled in in too great detail, prospects for railroad business appear to be very good for a fairly long time after the end of the war and the probability is that all roads will spend to the limit justified by their income in those and other activities. With this in prospect the need for labor is evident. We know, though, that those now employed in the railroad mechanical departments, together with those formerly employed who return from service to claim old positions, will not all be required for shop work.

This, then, is the time for a little long-range planning. The industries which, after the war, can best handle their relations with their employees will be those least likely to find government interference increased in other problems of management.

New Books

TORQUE CONVERTERS. *By P. M. Heldt. Published by the author at Nyack, N. Y. 406 pages, 5 in. by 8½ in., illustrated. Price $4.*

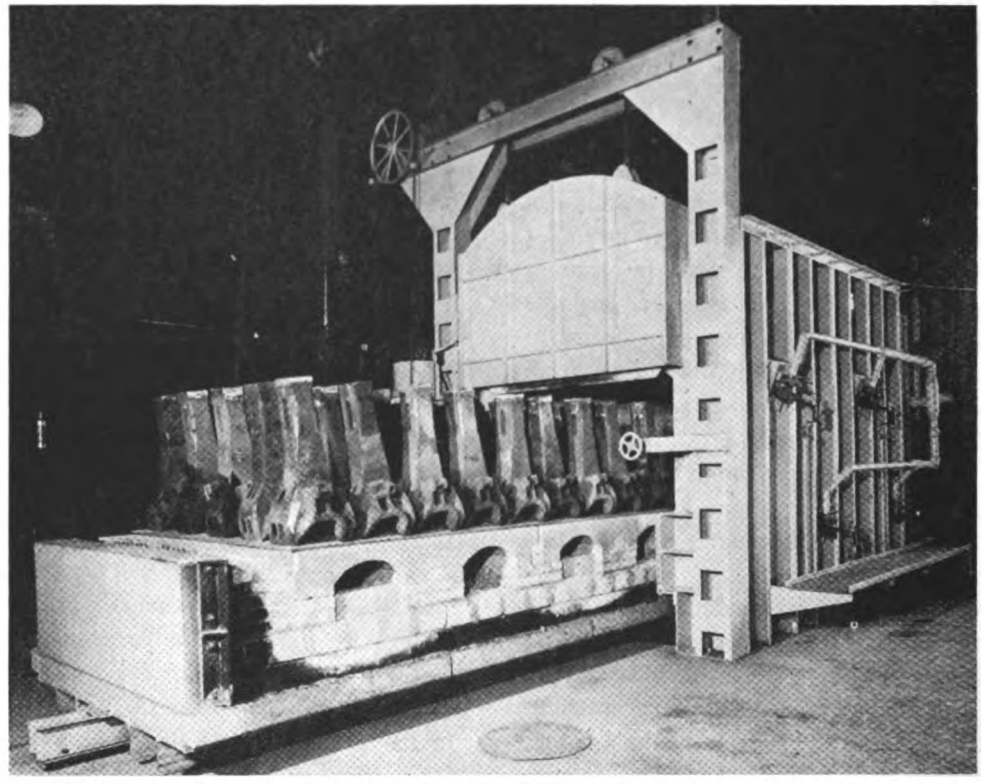
The interest in and the curiosity on the part of many persons as to the potentialities of mechanical and hydraulic transmissions for railway vehicles would justify a careful reading of this book. The entire volume is devoted solely to the subject of transmissions or torque converters. While, of course, a large part of the volume is concerned with transmissions for highway vehicles which, as the author says, are in use by the millions there is also a thorough presentation of the transmissions in use in rail vehicles. The 17 chapters dealing with clutches sliding gear and planetary transmissions, hydrostatic, hydro-kinetic and a variety of special transmissions are well supplemented with numerous drawings. The detailed discussion of the design and functioning of these various types forms an excellent background of technical knowledge for a consideration of the use of these types in railroad service.

MECHANICAL VIBRATIONS, THEORY AND APPLICATIONS. *By R. K. Bernhard, former head, Department of Engineering Mechanics, Pennsylvania State College. Published by the Pitman Publishing Corporation, 2 West Forty-fifth street, New York. 140 pages, 6 in. by 9¼ in. Price, $3.*

In the preparation of this book the author's purpose has been to provide students and practicing engineers who are not familiar with dynamics a sound introduction to an engineering knowledge of mechanical vibrations. The author emphasizes that it is not his purpose to give a complete treatment of the subject, which would require an extensive application of higher mathematics. The engineer interested in developing a working knowledge of the subject will find much useful material in the book. Unless he already has some familiarity with it, however, he is likely to find gaps in the material somewhat hard to bridge. The text of the book is divided into two parts. In the introduction the author gives a brief description of dynamics and the combined effect of dynamic and static loads. Following a section devoted to general definitions are sections on harmonic vibrations, damping, forced vibrations, coupled vibrations, superimposition of harmonic vibrations, and the resonance effect of girders. A second part of the book is devoted to methods and types of instruments for the measuring of vibrations.

With the Car Foremen and Inspectors

Coupler Reclamation



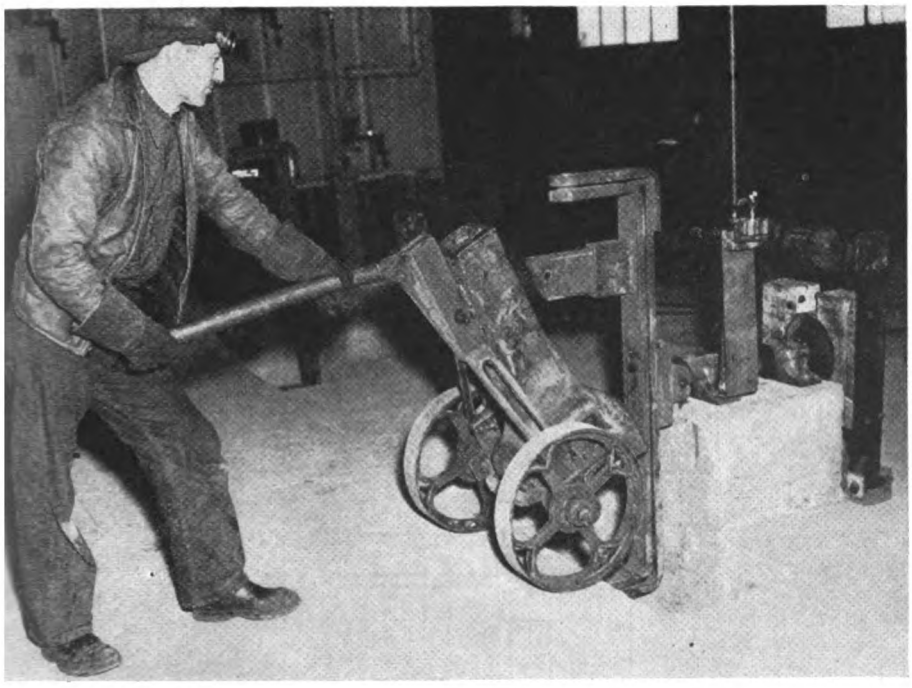
THE extension of A. A. R. Interchange Rule 23 to permit the reclamation of cracked or broken couplers by electric-arc welding, the welding to be followed by a carefully controlled normalizing procedure, is enabling railroads to maintain supplies sufficient for their requirements with a minimum demand on foundries for new couplers. The Erie which, with the Pennsylvania, cooperated with the Coupler and Draft Gear Committee of the A. A. R., Mechanical Division, in conducting the tests which preceded the recommendation for extension of Rule 23, has installed a complete welding shop at Meadville, Pa., for the reclamation of couplers. The coupler shop is a unit of the road's general reclamation facilities which are located at that point.

Test Procedures and Committee Findings

Early in 1942, the Coupler and Draft Gear Committee decided to study the welding of couplers to determine whether the practice, then regarded as unsafe, could not be approved, at least as an emergency measure. Couplers were welded at Erie and Pennsylvania shops, normalized and then given the same tests applied to new couplers. None of the test couplers failed in the welds, or otherwise, under standard tests. Since all test couplers had been prepared by the use of the electric welding process using shielded-arc electrodes, the committee's original recommendations covered only this method. Recent tests have been made for the committee to determine whether the rule shall be extended to include oxyacetylene welding.

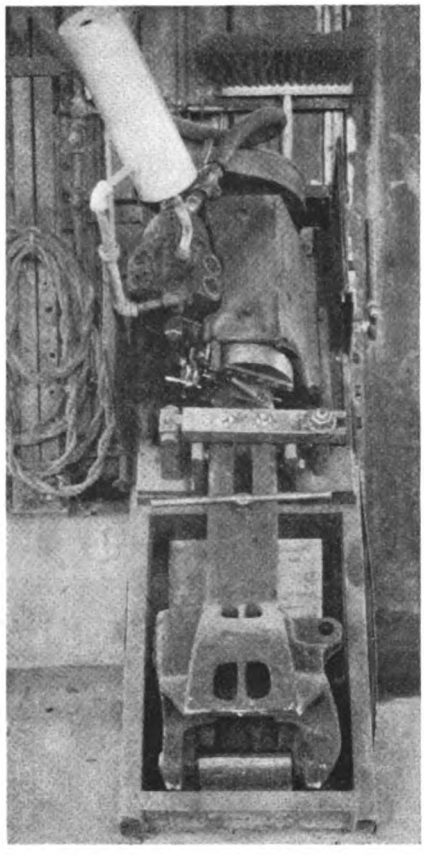
Normalizing Is Essential

In addition to the limitation that only cast steel couplers of Grade B carbon steel could be reclaimed, the definite requirement was made in Rule 23 that welding must be followed by controlled normalizing. Proper facilities must be provided in any shops undertaking this work to insure the relieving of all stresses created by welding and to relieve service fatigue and remove crystallization of metal in the coupler. Successful reclama-

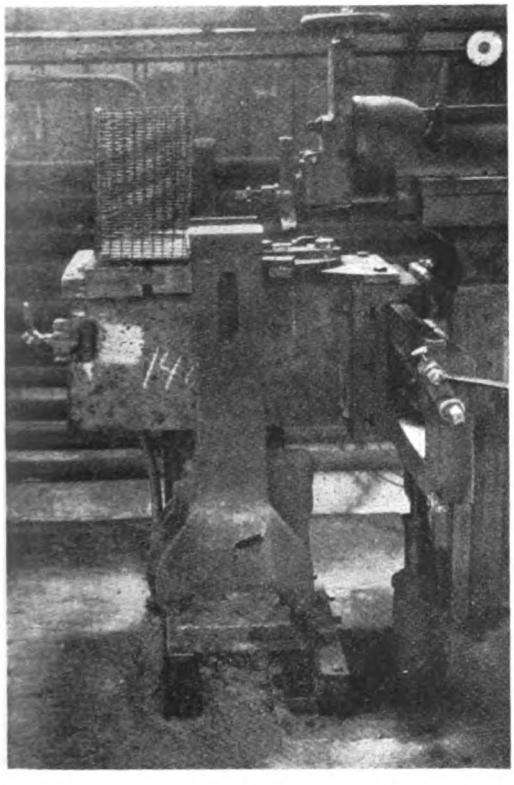


A specially-designed truck aids in the movement of couplers around the shop and serves to position them on the welding jig and for the various machining operations when required

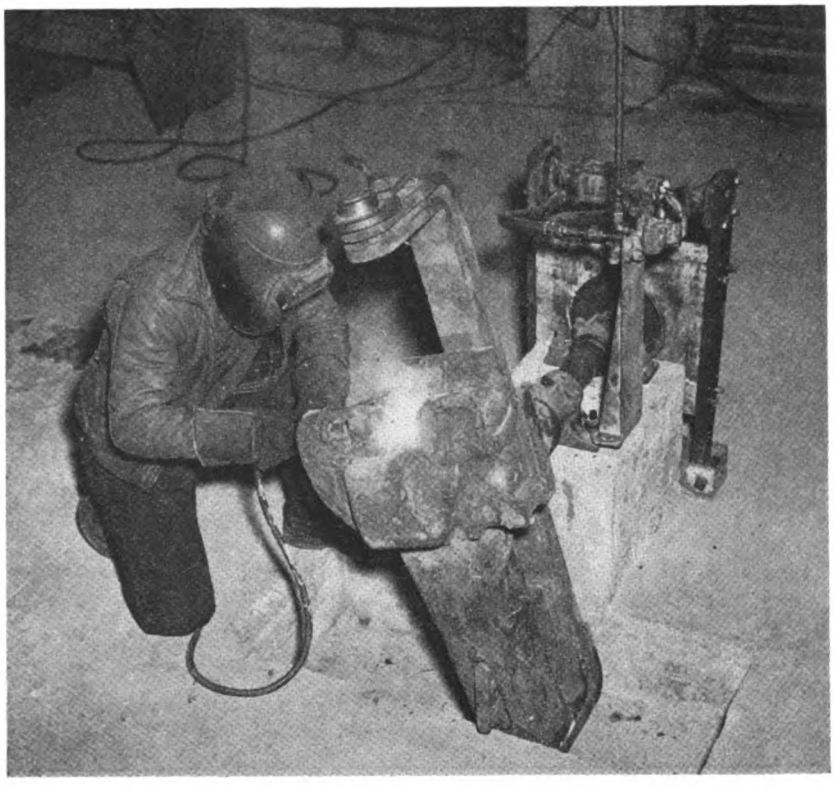
Machine built at the Erie shops for removing excess metal from the hole in the butt end of all straight shank couplers

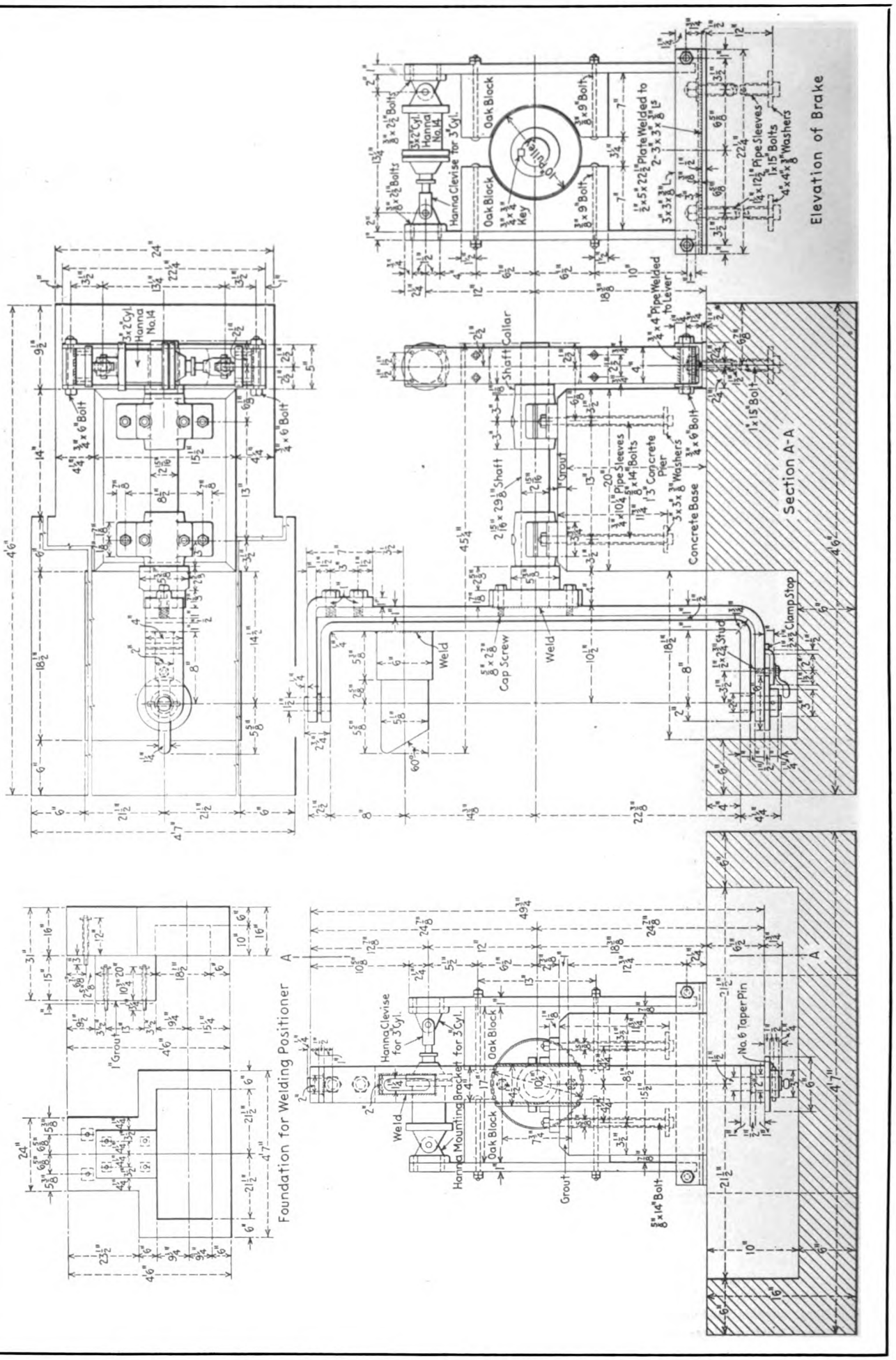


This device permits positioning any part of the coupler body for downhand welding

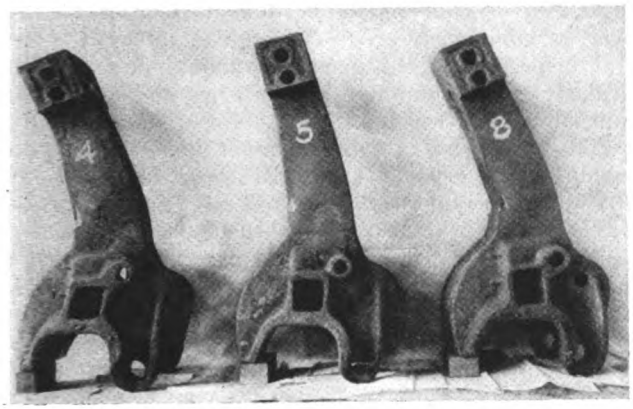


Shaper used in squaring coupler butts—Build-up plates are then welded on to restore shank length





Welding positioner designed by Erie engineers for use in the coupler reclamation plant at Meadville, Pa.



Welded couplers after being tested according to procedures standard for new couplers—None failed in the weld—The bending of the shanks and spreading of the guard arms resulted from the severity of the test and are not signs of defects



A good shank and a good head can be joined by welding—This coupler was tested to destruction as the cracks in the head show but the weld did not fail

tion depends upon this treatment. Section (gi-8) of Rule 23 requires that couplers after welding, must be normalized in a furnace which is equipped with a satisfactory temperature measuring device. The furnace temperature must be raised gradually within a two-hour period to a temperature of between 1,500 and 1,600 deg. F. This temperature must be maintained for a period of from 1½ to 2 hrs. Couplers then are removed from the furnace and allowed to cool in still air, protected from drafts, rain or snow. Quenching is not permitted.

Erie's Facilities

No existing shop installations on the Erie could be converted readily to coupler reclamation and it was decided, therefore, that a separate shop for all such reclamation would be located at Meadville. A Mahr car-bottom furnace which has a platform area large enough to accommodate 45 couplers in an upright position was purchased and installed in the shop. The furnace is equipped with temperature controls which control the temperature variation during the entire normalizing period within 10 deg. plus or minus, of the 1,580 deg. F. at which the charges are normalized. Tape records from a recording pyrometer are kept for each lot of couplers treated in the furnace.

Four 300-amp. electric welding machines have been installed for the use of operators engaged in the welding of couplers and related parts. At present two specially designed welding jigs have been found to be sufficient to keep the shop abreast of the current demand for reclaimed couplers. The jigs permit the positioning of couplers so that welding on any portion of the coupler body or shank can be performed in a down-hand position. Little effort is required on the part of the operator to turn the coupler in the jig to the position desired and a braking arrangement then holds the coupler in the position to which it has been adjusted.

Other Welding Shop Devices

When a plate must be welded on the butt of a straight-shank coupler to restore the normal length, the coupler to be prepared is first placed in a machine which serves to remove the excess metal in the hole in the coupler butt. This machine is driven by an air motor and is so built that a tool, mounted on a revolving head, cuts off the excess metal which has resulted from end batter on the coupler. The feed is adjusted so that the tool advances with each revolution of the head.

The butt of the coupler is then squared and faced on the end and outside surfaces after which the coupler is placed in the welding jig and a rebuilding plate is welded to it. These same two machines can be used where the building up of the butt end of the coupler is done entirely by welding.

A truck designed to facilitate the handling of couplers about the shop serves also to place them in position for machining and the welding operations. When welded the couplers are placed on the furnace car by means of an air hoist which travels on an overhead trolley.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Charge for Side Bearing May Not Exceed Cost of Standard

The Southern Pacific Company applied a new side bearing to P. F. E. car No. 36850 account owner's defect and billed the Pacific Fruit Express Company its net store department cost in accordance with Rule 105. Wrong repairs were not claimed but the owner contended that its standard was a non-patented article purchased in a competitive market and that the charge should be reduced to 17 lb. of malleable iron in accordance with Item 112 of Rule 101. In the submission of the case attention was also directed to the first interpretation following Rule 88 and to Section (e) of Rule 87.

In a decision rendered November 13, 1942 the Arbitration Committee held that: "Charge should not exceed cost of truck side bearing standard to car. The contention of car owner is sustained."—*Case No. 1791, Pacific Fruit Express Company versus Southern Pacific Company.*

Replacing Wheels With Remount Defects

A pair of wheels was removed from A.R.T. car No. 22520 because of a cut journal by the Chicago, Rock Island & Pacific. The pair of wheels was placed in a journal truing machine and the journal bearing surface was reconditioned, after which the wheels were placed under the car and the car released. Remount gages had been applied when the pair of wheels was removed and the repair record card showed one wheel "Vertical flange R. M. G.—Rule 82-V" and the other "Tread worn hollow—Rule 82-W". Eleven days later the car was ordered to owner's shop where the wheels were removed and scrapped. The owner claimed an adjustment quoting Interpretation No. 8 to Rule 98 as authority. The railroad contended that this rule was not applicable and that Arbitration Case No. 1637 was governing because the wheels when reapplied were in the same serviceable condition and would give the same length of service after the journal was conditioned since there was no physical change in the wheels by reason of the journal having been cut. It further stated that the fact that the billing repair card showed that the wheels took the remount gages was not evidence that the wheels were then condemnable and scrap.

In a decision rendered November 13, 1942, the Committee held that: "Inasmuch as the wheels and axle were not removed from service, no adjustment should be allowed. The contention of the Chicago, Rock Island and Pacific is sustained."—*Case No. 1792, American Refrigerator Transit versus Chicago, Rock Island & Pacific.*

Air Brake Questions and Answers

Installation and Maintenance of Axle Generators

201—*Q.—What method should be followed in order to mount the generator on the journal box? A.*—In order to mount the generator on the journal box an adapter plate (Ref. 2—Fig. 10A) is required. The outer face of the adapter plate is machined to receive the V-section rubber cushion ring (Ref. 19—Fig. 10) furnished on each generator for the absorption of shock and vibration, and is also tapped for bolts to fasten the clamping ring (Ref. 3—Fig. 10A) which clamps the generator in place. Before placing the generator in the adapter plate, pre-assemble the clamping ring over the generator by temporarily removing the generator cover and threading the clamping ring over the plug connector and cable. With the drive mechanism on the generator and axle in proper engagement, bolt the clamping ring tightly to the adapter plate and secure the bolts with lock wire. The two projections on the front of the cushion ring engage in notches on the clamping ring. They are spaced at 180 deg. and with the clamping ring loosened the generator can be rotated in the mounting as desired.

202—*Q.—What should be done insofar as maintenance is concerned?* A.—At regular intervals a general inspection of the generator should be made, particularly the commutator and brushes and a check for journal box oil leakage.

203—*Q.—What attention should be given the commutator and brushes?* A.—Brushes, (Ref. 38—Fig. 10) that are under ⅜ in. in overall length or in any way chipped or cracked and brush springs which are broken or deformed should be replaced. If the brushes do not slide free in the brush holder, remove any obstruction preventing this. Wipe off the commutator and when necessary clean with No. 00 sand paper. If pitting is evident on any of the commutator bars, remove the generator and give it a voltage test. When the commutator shows signs of excessive wear remove the armature and recondition the commutator.

204—*Q.—How would you check for leakage of journal box oil into the generator?* A.—Remove the ¼-in. pipe plug at the bottom of the generator housing and check for leakage of journal box oil into the generator. If there is evidence of oil leakage, remove the generator and re-pack the rear bearing and grease cavity only using automotive type wheel bearing grease and replace the felt oil ring (Ref. 12—Fig. 10) in the rear end bell. At all times maintain the rear bearing cavity well filled with the specified grease, as this is important in the prevention of oil leakage.

205—*Q.—How can the rear bearing cavity be filled with grease?* A.—This can be accomplished by removing the ⅛ in. pipe plug in the rear end bell and applying the nozzle of a pressure grease gun directly to this opening without the use of a pressure grease fitting.

* * *



A simple and effective device for scooping spikes out of a box or nail keg with all "heads up" ready for inserting in a pneumatic spiking machine—This device was submitted as a suggestion at the Michigan City, Ind., shops of the Pullman-Standard Car Manufacturing Company

Approximately four operations of the grease gun will find the bearing cavity and its fullness will be indicated by an overflowing of the grease from the hole when the gun is removed. A pressure grease fitting must not be used because the pressure developed would force the lubrication through the seal of the rear bearing into the generator housing.

206—*Q.—What attention should be given the drive couplings?* A.—Examine the drive couplings, particularly those of the Type B, and if there is any looseness of the assembly on the armature shaft, securely tighten and lock the drive coupling clamping nut.

207.—*Q.—What should be done where there is evidence of bearing wear?* A.—Remove the armature and replace the bearings before damage occurs to the armature.

Carpet Saved by Upholsterer's Idea

According to the July Pullman News, J. J. Kelleher, upholsterer for the Pullman Company at the Wilmington, Del., repair shop, has been awarded a cash bonus of $900 for the method of repairing carpets which he suggested somewhat over a year ago. Briefly stated, the method consists simply of cutting out worn sections of carpet, accurately matching either slightly-worn or short new pieces and cementing them together as necessary to give the required size or length. One year's experience showed that this practice saved 1,943 yards of carpeting which is hard to get and represents about 4,000 lb. of wool. The cash award was made under the Pullman policy of paying 10 per cent of the net saving of an idea submitted by an employee.

By referring to the illustrations the general procedure in repairing carpets by this method will be apparent. After the worn section of carpeting has been removed, the carefully matched and accurately cut edges of two good pieces are brought together upside down over a smooth board, as shown in the first view. A strip of feather-edge tape and CeamLoc broadloom cement, furnished by L. C. Chase & Co., Inc., New York, are then applied and, when the cement has set, hold the carpet edges so closely and securely together that practically no evidence of a seam is observable on the upper side of the carpet.



How the backing strip is cemented on the carpet seam



The matched seam in a repaired aisle carpet is invisible

The first illustration shows Mr. Kelleher applying the cement to the reverse side of a carpet seam, while W. C. Dean, Pullman shop superintendent at Wilmington, watches the operation. In the second view, the appearance of the back of the cemented seam is indicated and the third shows Mr. Dean pointing to the seam which is invisible on the upper side of the repaired aisle carpet.



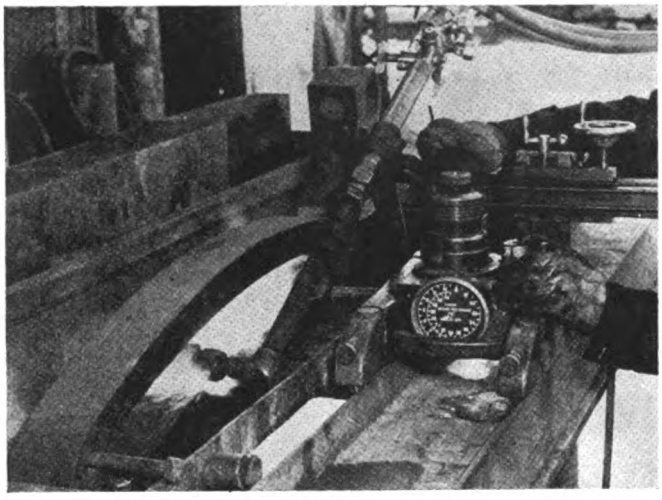
Back of the carpet after the seam has been cemented

Railroad Shop

Flame Hardening

By Stephen Smith
and
J. G. McIlhiney*

WITH wear-prevention gaining in significance as the nation strives to conserve its metal, there is perhaps no surface-treating method whose results excel those of the flame hardening process once its possibilities are understood and its technique is mastered. Its advantages have resulted in its adoption as a standard operation in the surface hardening of the wearing parts of machine elements.



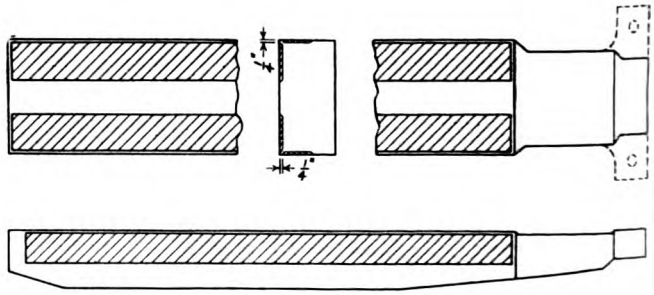
Valve-gear links can be flame hardened—Some have shown little appreciable wear after two years of service

Although flame hardening by torch was practiced nearly 30 years ago by toolmakers, continued experience with improved apparatus has extended the use of the process in many fields. Its adoption as a routine practice by certain American railroads is among the more outstanding of many such examples. A number of railroads have experimented during recent years with the flame hardening of a large variety of locomotive parts including crosshead bar guides, piston heads, valve gear links, link blocks, knuckle pins and bushings, gears, racks and pinions, radial buffers, rocker seats, spring saddles, spring equalizers and valve pilot wheels.

Two Big Advantages

In the railroad shop, as elsewhere, the principal advantage of the flame hardening process lies in the fact that it can be used to obtain full hardness on the surface of a casting or forging which already has been heat treated to give the maximum in physical properties for core strength. When this characteristic of the process is viewed in the light of its ability to provide small hardened areas on parts of large size, especially when a high degree of hardness is required, the value of this combination of properties becomes apparent. The process results in a gradual change of hardness between the hardened surface and the relatively ductile core, thus binding the surface securely to its base.

The flame hardening process does not alter the chemical composition of steel and this characteristic sets it apart from case hardening, carburizing, nitriding and other practices which involve a chemical surface-change. By raising the surface of a part above its critical temperature with the intense heat of an oxyacetylene flame and following with a quench a surface of the hardness required is produced while the core remains tough. A strictly neutral oxyacetylene flame is used and the hardness is produced solely by the quenching and not by any additions to the steel of carbon drawn from the oxyacetylene flame. It is a time-saving process demanding a fraction of the time that would be required in furnace hardening, and it results in a considerable saving in the costs of machining and grinding, since flame hardening is usually done on finished surfaces.



Shading indicates areas to be hardened on a guide—Flames are kept from the edges to prevent cracks and thermal checking

Controlled Hardness Depth

The extremely rapid form of heating used makes it possible to obtain a depth of hardness from a mere skin to ¼ in. according to the steel analysis and the operating methods employed. The hardness depth can be predetermined and held uniform because the speed of the

* Applied Engineering Department, Air Reduction Sales Company, New York.

heat input is under exact control. Maximum hardness can generally be maintained through two-thirds of the hardened depth. A sharp line of demarcation is avoided between the hardened zone and the core. This physical condition results in an increased toughness which, combined with the higher hardness, produces excellent wear resistance.

The process, in certain instances, has made it possible to produce a greater surface hardness on a particular metal than could have been obtained by any other method of heat treatment. This is caused by the extreme and sharply defined difference in temperature between the heated surface and the core. The resultant fast flow of heat into the cold base region greatly speeds the



Flame hardening a knuckle pin—The torch is held in a stationary position while the part is revolved slowly in a lathe

quenching action when its effect is added to the usual flow of heat absorbed by the externally applied quenching medium. The faster the rate of cooling from above the critical temperature the greater the hardness and such double quenching action can hardly be obtained on the surface of a part which had been heated in a furnace to a hardening temperature throughout. Since only a shallow layer of metal is raised above the critical point and the cooling is both internal and external the flame process permits greater freedom in the treatment of critical steels prone to check or crack in furnace hardening.

It is important in the application of flame hardening to control the rate of heat input so that the surface of an object will be heated sufficiently but not overheated. The lowest heat which will give the desired results should always be used. Excessive temperatures for high hardening effects should be avoided because greater hardening strains are produced. The rate of torch travel must be uniform. An uneven speed which gives a non-uniform heat input results in varying degrees of hardness across the surface.

The amount of distortion encountered in flame hardening is usually well within acceptable limits. Normalizing or annealing to equalize stresses should precede the hardening treatment whenever it is possible. Because the process is primarily a localized surface-treating method it results in less distortion than when an entire object is heated and quenched.

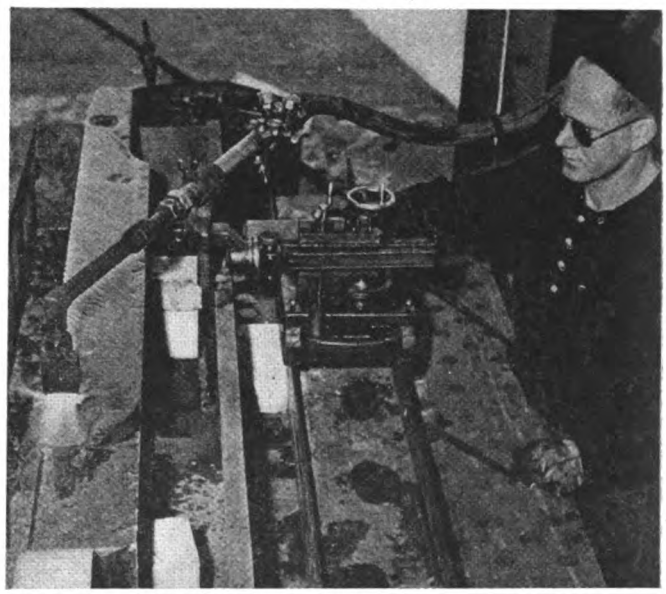
Methods

The flexibility of the flame process permits the use of a number of different methods for the production of surface hardening. The size and shape of an object, and the way it is situated, dictate the choice of the method best suited for a certain job. In all of the methods it is necessary to provide mechanisms that establish a complete and handy control over heat input, quenching rate and torch speed. Flame hardening is a metallographic process which will not yield consistent and uniform results unless all its essential variables are subject to swift and precise adjustment.

The spot hardening method is the simplest flame hardening procedure and is usually applied to small areas. The area under treatment usually can be brought to heat by the use of a standard welding torch. The heated surface is then quenched.

The progressive method of flame hardening is the one most used in railroad shops. A torch with water-cooled, multi-flame tip and self-contained quench is usually mounted on a carrier and traveled across a flat surface at a uniform speed heating the surface to a uniform temperature. Tips 12 in. in width have been made for hardening wide areas, but general practice is to use narrower tips, 3 in. or less in width, to harden successive bands. The heating tip is followed closely by the quenching stream and uniform hardness is imparted because the cooling action is uniform. Whenever areas wider than the tip are to be hardened several contiguous parallel passes must be made over the surface. An auxiliary water quenching stream should be applied at the ends of the rows of flames. It should be directed on the already hardened area to prevent drawing the hardness from these zones. With care, it is possible to prevent overlapping or overspacing in making these parallel passes, and any narrow, soft area between passes can be held to a minimum.

On cylindrical surfaces four different methods can be used; the progressive band method, the progressive spiral method, the spinning method, or the progressive spinning method. The first of these methods can be employed to create a continuous succession of individual hardened bands around the surface of a cylindrical object such as a large-diameter shaft or cylinder. The



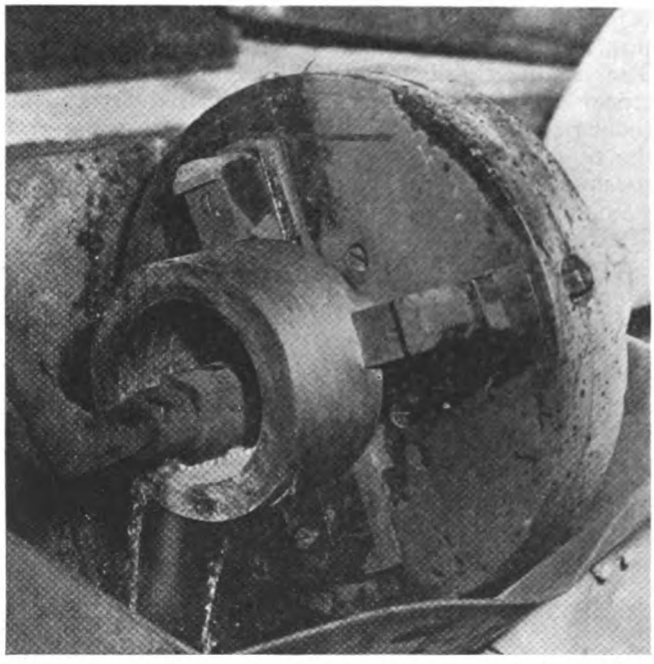
A hardness of 60 Rockwell C with a hardening penetration of 3/32 in. can be obtained on guides

torch is fixed and the object is revolved at a surface speed of from 3 to 10 in. per min. past a multi-flame tip until a complete turn has been made. The widest tip available should be employed and must be followed immediately by a quenching stream. At the end of each com-

plete revolution the torch is moved to the proper position for hardening the next band.

When the spiral method is employed the object is revolved at a surface speed of about 3 to 10 in. per minute. The torch and quench are mounted on a suitable carriage which travels parallel to the axis of the part. The speed of travel is synchronized with the speed at which the part is revolved so that the carriage advances a distance equal to the width of the tip for each complete revolution of the object giving a fully hardened spiral band the full length of the part.

In both of these methods an auxiliary quenching stream should be applied at the ends of the rows of heating flames to prevent the flow of heat from drawing hardness from the adjacent already hardened area. Both methods are direct adaptations to circular work of the progressive technique applied in hardening flat surfaces



The progressive band method of hardening is used on knuckle pin bushings

except that the work itself is moved slowly past the heating flames and quench jets.

The spinning method is employed on cylinders, shafts, journals and other parts where narrow bands of complete circumference are to be hardened. Such objects may be processed by mounting them on a spindle, lathe or other machine tool and spinning them at relatively high speeds up to 1000 circumferential inches per minute under heating tips equal in size to the width of the surface to be hardened. The number of tips required is determined by the diameter of the shaft. When the entire circumferential surface has been raised to the hardening temperature the heating flames are withdrawn or extinguished and a quenching stream is applied to the spinning surface. If the part is small it often can be released quickly from the holding device and dropped into a quenching bath. In hardening large-diameter surfaces by this method, several tips are positioned equally about the circumference to insure a rapid rate of heat input and adequate penetration.

The progressive spinning method is used to harden uniformly round surfaces of extended length. This method permits the hardening of such surfaces without producing any zones of lower hardness. It is accomplished by spinning the object before multiflame heating tips which travel at a constant speed along the surface of the part being spun. The flames produce a circumferential heated band on the surface of the work. The heating tip travels longitudinally at a speed of 4 to 10 in. per min. and is followed by a circular quenching stream, producing a continuous, uniformly-hardened surface. The circumferential speed of revolution may range from 600 to 1,000 in. per min. A number of individual flat tips may be spaced equally about the object's circumference or a circular tip followed by a quenching ring concentric with the circumference may be employed.

Quenching

Water is the quenching medium most frequently used in flame hardening. An air quench may be sufficiently drastic to give the desired results on certain types of steels. In some instances oil or soluble oil solutions are used.

Quenching attachments for progressive hardening usually are attached to the heating head or are an integral part of the head and a constant relation between the heating and quenching operations is assured. Quenching devices are of many types. They range from a single stream of water from an ordinary nozzle to spray nozzles which have been carefully designed to fulfill a special purpose.

It is important that the quenching jet be placed at the proper distance from the heating tip. If the flame and jet are positioned too far apart the result will be partially hardened metal for the metal will be partly cooled before it is quenched. Similar results will occur if the jet is placed too near the flame for then it will interfere with the flame or with the heating of the metal.

The quenching medium controls the cooling rate which depends upon the volume of the medium and, to a certain extent, upon its original temperature. The cooling rate also is determined by the method of cooling inasmuch as a more rapid quenching action is afforded by water sprayed under pressure than by water in a still bath.

Materials

The choice of materials suitable for flame hardening depends upon the service required. Where surface hardness is a primary factor, no advantage has been found in the use of alloy steels. Alloy steels, however, are quite essential where higher core strength and greater shock resistance may be necessary.

Flame hardening may be used on all SAE steels of 0.30 per cent carbon content or greater. The best range appears between 0.40 and 0.70 per cent carbon. In general, all steels that can be hardened by standard furnace methods also can be flame hardened. Fine-grain steels are best suited to the process. Care must be taken not to overheat coarse-grained steels. Overheating further coarsens grain structure and causes surface checking. The degree of hardness obtainable depends chiefly upon the carbon content of the steel but is, of course, influenced by the amount of the alloying elements present.

Effective on Guides

By its very nature the flame hardening process tends to avoid internal strains and holds distortion to a minimum. This attribute makes it of particular value in the treatment of locomotive parts. In the whole range of processing such parts no phase of the process holds a greater possibility of economy than does the flame hardening of crosshead guides. Numerous shops have ex-

perimented with these guides during recent years, generally with success. When the results have been disappointing, it has usually been due to the employment of steels of too low or of an unknown carbon content, or to an adequate understanding of the procedure and, sometimes, to both factors.

One gratifying result of a well-calculated procedure was reported by one railroad where a locomotive equipped with flame hardened guides recently completed three years of service with the guides still in first-rate operating condition. On this road it is standard practice to flame harden the guides of all locomotives sent to the shop for Class 3 repairs. In the experience of other roads, the service life of guides has been at least tripled by flame hardening.

Before a guide is installed on a locomotive it must be straight to within a few thousandths of an inch. Experience has shown that prebending a guide, by heating its back before hardening, gives consistently good results in coping with such distortion as may occur when the guide is flame hardened. Both the size of a guide and its original alignment are factors which influence procedure. If heating the back of a guide does not give a prebend sufficient to overcome final distortion, more heat can be applied to the back after the guide has been hardened. A bulldozer or an hydraulic press also can be used to give a guide a prebend which is straightened when the piece is subjected to flame-hardening heat.

Other Parts

Flame-hardening can be used successfully on Walschaerts valve motion links. The tip must be wide enough to cover all the bearing surface except a ¼-inch margin at each side, the usual precaution against corner checks and cracking. At a torch speed of 6 inches per minute such links can be hardened to 60 Rockwell C in about 10 min. actual hardening time. At this speed the depth of hardness will ordinarily be 1/16 to 3/32 in., but the hardness penetration can be increased to ⅛ in. by slowing the pace of torch travel. Flame-hardened valve links have shown little wear after two years of operation; not enough to require repair. Link blocks render similar service after being flame hardened. The operation requires three to five minutes. Knuckle pins and bushings for various types of locomotives have been successfully flame hardened. Depending upon the penetration desired, ranging from 1/16 to ⅛ of an in. it takes about 6 to 10 minutes to harden the average-size knuckle pin to 60 Rockwell C. The average bushing can be flame treated to the same hardness in the same time. Pins and bushings so treated are reported to have given service two to four times as long as unhardened parts.

Radial buffers have been flame hardened with very good results by the use of a 4 in. tip to make successive passes across the entire face of the buffer. It takes about 30 minutes to flame treat the face of an average-size buffer and, when hardened to 450 Brinell and to a depth of ⅛ to 3/16 in., they have shown but 1/16 in. of wear after three years of service.

Ever since their early adoption of the method for the purpose of hardening rail ends to eliminate batter, railroads have been among those industries most interested in the application of the flame hardening process to heavy, surface-wearing parts. Both experimentally and in standard operations, many roads are steadily engaged in extending the usefulness of the method not only for the benefit of locomotive equipment, but also to prolong the service life of excessive-wearing car parts.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Protecting Staybolts Against Cinder Cutting

Q.—Is it satisfactory to apply a bead of weld in front of a staybolt head to prevent cinder cutting of the staybolt?—M. O. R.

A.—The practice of welding a semi-circular bead of welding around the front of a staybolt head to act as a shield against cinder cutting is satisfactory. This method of preventing cinder cutting of staybolt heads was recommended by the committee reporting on the Causes for Cinder Cutting of Firebox Sheets, Flues, Tubes and Smokeboxes to the Master Boiler Makers' Association. Caution, however, is needed in continued rewelding in the same spot. Continuous welding at a given point will eventually result in cracking in the undercut of the weld on the parent metal.

In the discussion of this report, one member stated that he had tried this method and found that the cinder cutting continued, but that it took place just at the edge of the weld deposit into the side sheet adjacent to the welded collar.

Seam Efficiencies

Q.—I am enclosing a sketch of a longitudinal seam used on the first course of a Pacific type locomotive. The rivets in this seam have been spaced to include the front tube sheet brace. What effect does the spacing of the longitudinal seam rivets to include the front tube sheet brace rivets have on the efficiency of the seam, as compared to a standard quintuple riveted seam? —M. E. F.

A.—Fig. 1 illustrates the longitudinal seam as submitted with the question. Fig. 2 illustrates a typical quintuple riveted seam which would have been used for this seam had not the front tube sheet braces come into the seam area.

An examination of these two seams indicates that they are identical as to strength with the exception that the seam in Fig. 1 has one more rivet in single shear than the seam in Fig. 2. The strength of this additional rivet would be divided between the front and back unit sections of the seams while the two center unit sections, when examined for failure are found to be identical for both seams as illustrated in Figs. 1 and 2. The seams may fail in the following ways: (1) Tearing of plate between rivet holes in outside row; (2) tearing of plate between rivet holes in the third row and shearing one rivet in single shear in the outside row and one rivet in single shear in the second row; (3) tearing of the plate between rivet holes in the fourth row and shearing one rivet in single shear in the outside row, one rivet in single shear in the second row and two rivets in single shear in the third row; (4) shearing eight rivets in double shear in fourth and fifth rows and four rivets in single shear in first, second and third rows; (5) tearing of plate between rivet holes in the third row and crushing welt

strip in front of one rivet in the outside row, one rivet in the second row and two rivets in the third row; (6) tearing of plate between the rivet holes in the fourth row and crushing the welt strip in front of one rivet in the outside row, one rivet in the second row and two rivets in the third row; (7) crushing plate in front of eight rivets in the fourth and fifth rows

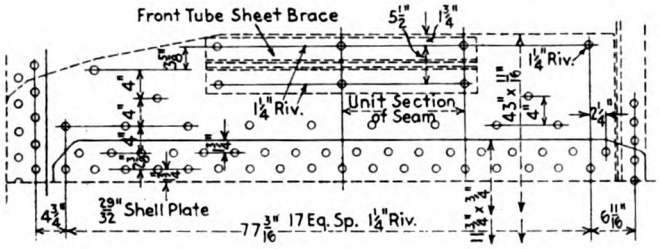


Fig. 1

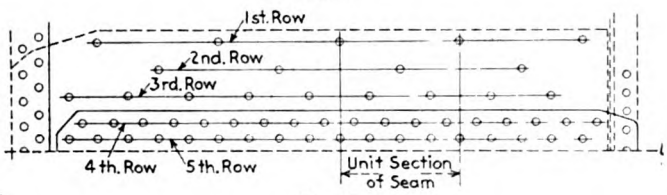


Fig. 2

and the welt strip in front of four rivets in the first, second and third rows and (8) crushing the plate in front of eight rivets in the fourth and fifth rows and shearing four rivets in single shear in the first, second and third rows.

Based on the above methods of failure for unit section of seams, both seams would have the same efficiency and the respacing of the rivets in the seam for the front tube sheet brace, as illustrated in Fig. 1, would not effect the efficiency of the seam over that of the standard seam having the same longitudinal dimensions.

Flanging Throat Sheets

Q.—What is the procedure for flanging locomotive throat sheets? Are these sheets flanged in one operation?—E. R.

A.—In shops equipped with a flanging press large enough to handle the work, the process of flanging throats sheets is carried out in a single heat and a three-piece die is employed. This die consists of a male piece, a female piece and a plunger or ball. These are set up for operation with the ball portion of the die first hung from the top ram. The male and female portion are set in the press together and lined up with the ball after which the female die is fastened to the table and the male portion fixed to the top platen.

The throat sheet is laid out and trimmed to size with enough excess material retained to serve as a tie piece in flanging. At the bottom of the plate, in line with the center line, a cold chisel mark is made to enable the flangers to line up the heated plate in the die.

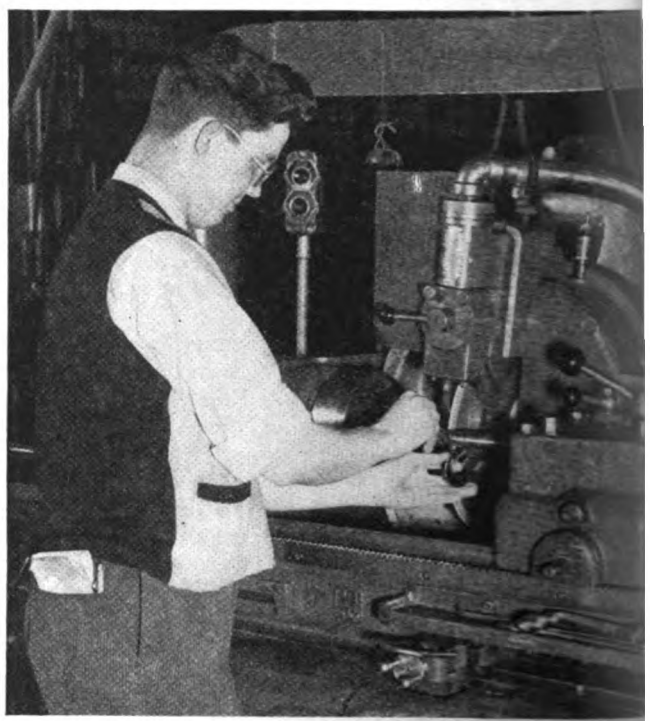
The plate is heated in an adjacent furnace and placed in the die. After being lined up, the male and female portions of the die are brought together and the plunger is then brought into action to form the front flange. The sheet is removed from the press and allowed to cool slowly before being transported to the surface block for lining up. When the throat sheet is completely flanged the tie piece is removed with a torch.

The complete fabrication of flange plates is controlled by one man located at a station at the side of the press where all the control levers are placed. The furnace door lever, winch control, table lever, top ram lever, jack lever and center ram lever are within easy reach of this man and facilitate the rapid completion of flanging operations while the plate is in its most favorable working state.

Hand flanging is resorted to only when no dies are available to fabricate the material on a hydraulic flanger.

Quick Calipering of Root Diameter of Acme Threads

A micrometer caliper with special attachment for measuring the inside diameter of Acme threads is shown in the illustration being used by the operator of a grinding machine at the Hammond, Ind., plant of the Pullman-Standard Car Manufacturing Company. The particular part being machined is the threaded rod for a trench



Micrometer and special attachment used in measuring the root diameter of Acme threads

mortar and, in grinding this thread, it was discovered that the most time-consuming operation was calipering the diameter of the thread at the root which must be held to a tolerance of .004 in.

To speed up this operation and contribute to the war effort, a small metal plate was firmly fastened to the micrometer anvil by two small cap screws and designed with two projecting ribs, set at the proper helix angle and so spaced that they span three of the Acme threads. These bear on the bottoms of the outer threads and the micrometer head and barrel comes in line with the root of the intermediate thread. The micrometer is thus quickly and accurately placed and a direct reading of the inside thread diameter is secured. This type of micrometer and attachment may well be used wherever Acme threads are cut in quantities and accurate measurements are required.

General Electric Shop Kinks

Out of the stepped-up operations of industrial plants working at top speed on defense contracts have come many new ideas from workmen and supervisors that have contributed immeasurably to increased output. A large number of these ideas, of which those in this article from the General Electric Company are typical, are directly applicable to the work of railroad repair shops. All of these devices were developed at the G. E. Schenectady Works with the exception of that shown in Figs. 5 and 6, which came from West Lynn. The tools shown in Figs. 3 and 4 and in Fig. 7 were developed by J. De Fillippo and Charles Bogue, respectively, workmen at the Schenectady Works.

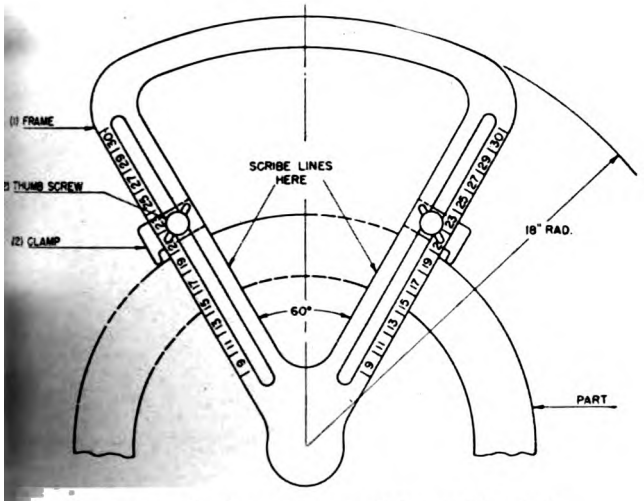


Fig. 1—Details of construction of the scribing tool



Fig. 2—Workman using scribing tool to lay out a metal ring

Layout Tool Saves Scribing Time

The layout tool shown in Figs. 1 and 2 was designed to simplify the scribing of a metal packing ring that must be sawed into six equal segments.

The tool has two arms at a 60-deg. angle inasmuch as the rings are cut into six segments, and it has a radius of 18 in. to accommodate ring diameters ranging from 9 to 31 in. Each arm is marked with a scale in ¼-in. graduations to correspond with the various outside diameters of the rings handled. The arms are slotted, and a movable clamp can be set and locked at the desired position along each arm by tightening a knurled thumb screw.

To use the tool it is only necessary to measure the outside diameter of the ring to be cut, and then set the clamps at the corresponding measurement marked on each arm. The operator then scribes a line across the ring along the outer edge of each arm, and using each line scribed as a guide for the next one, completes the layout in five moves of the tool around the ring.

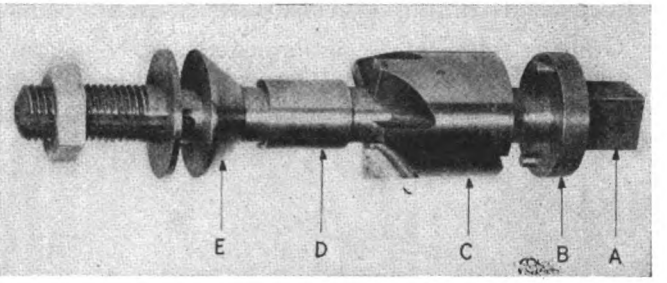


Fig. 3—Details of the spot facing tool

Spot-Facing Tool

A special hand-operated spot-facing tool shown in Fig. 3 overcomes difficulties encountered in securing a smooth seat for nuts and bolts through split hubs on rotor spiders Using the spot-facing tool is slightly more expensive than the chipping method formerly employed, but it does a superior job. Chipping left a rough surface no matter how carefully it was done.

The holes in the hub are inaccessible with ordinary spot-facing tools. This tool is built up on a shaft slightly smaller than the hole through the hub. The shaft is turned from 2½-in. stock. One end is made 1 in. square for 1½ in. *A*, where a ½-in. plate fitted with two ¼-in. pins is left *B*. The balance of the shaft is turned one inch in diameter and threaded on the end. Next, a 2¼ by 2½-in. cutter *C*, slotted on top for the ¼-in. pins, is slipped onto the shaft and the shaft thus assembled is slipped through the hole in the hub. Then a bearing sleeve *D* to fit the shaft and the inside diameter of the hole is put in place, followed by a bearing cone *E*. The threaded end of the shaft is slotted with a keyway to hold a washer and a nut in place, thus completing the assembly.

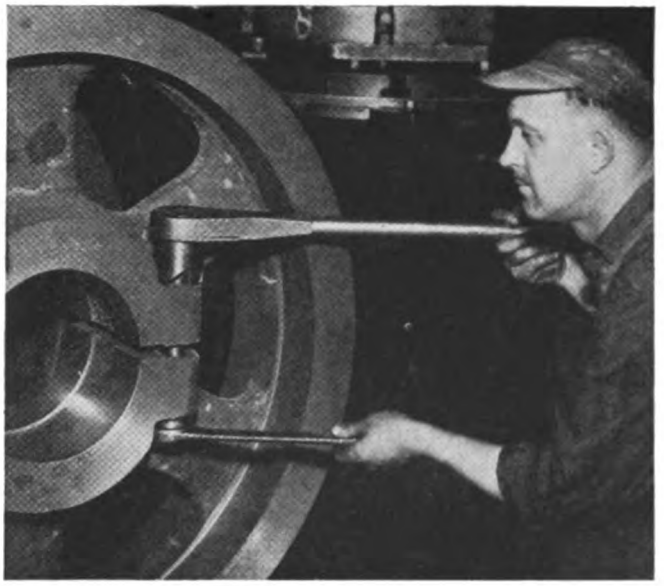


Fig. 4—The spot facing tool is hand operated by means of two wrenches

Motive force applied with a ratchet on the square end of the shaft, as shown in Fig. 4, while the cutter is tightened by means of the cone, washer, and nut. When one surface has been spot-faced, the assembly may be reversed to finish the opposite seat.

Forming Grinding Wheels With Contour Tools

Grinding wheels are being formed accurately and with minimum skill to almost any desired contour with a set

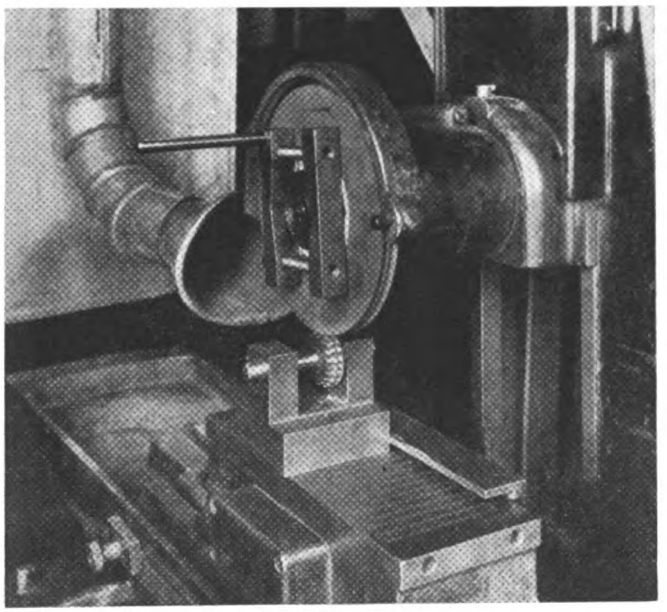


Fig. 5—Form-grinding wheel set up to be trued

of truing tools shown in Figs. 5 and 6 devised at the West Lynn, Mass., Works.

The tools are made from plain carbon steel, hardened glass hard. Radial saw cuts in the diameter of the tools are made after they have been turned on well-defined center holes. Spacing the saw cuts irregularly minimizes wear.

The tool is mounted in a holder provided with adjustable hardened male centers so that it revolves freely but with minimum play, and the device is then fixed upon a magnetic chuck. The operator revolves the wheel by hand, gradually feeding it down upon the circular tool. The wheel is rapidly formed to the desired shape, allowing the cut to run off so that the finish of the wheel face is smooth.

The wheel is then ready for form grinding. Ordinarily a part will be rough-ground and the wheel retrued before finishing. The retruing operation requires only a short amount of time and it is not necessary to remove the work from the machine.

Special Broach Solves Chip Damage Problem

The split broach shown in Fig. 7 overcomes difficulties encountered in broaching a blind keyway in a shaft and coupling to a tolerance of 0.0005 in.

Initially, a two-faced broach was developed for the

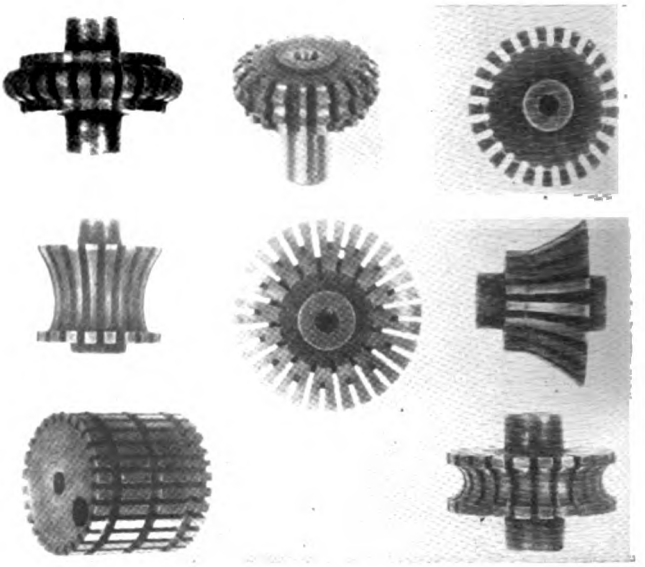


Fig. 6—Eight circular tools used for truing form-grinding wheels

job, one side having right-hand and the other side left-hand special teeth. The opposing angles of cutting equalized the strains and facilitated a straight cut. A space was left at the tip for the accumulation of chips which could be blown out after the broach was withdrawn.

However, it was found that chips from the back teeth damaged the front teeth as the broach was withdrawn, and a new broach had to be used after about a dozen

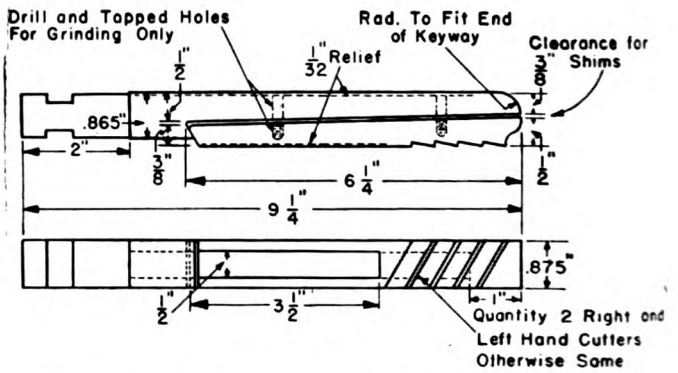
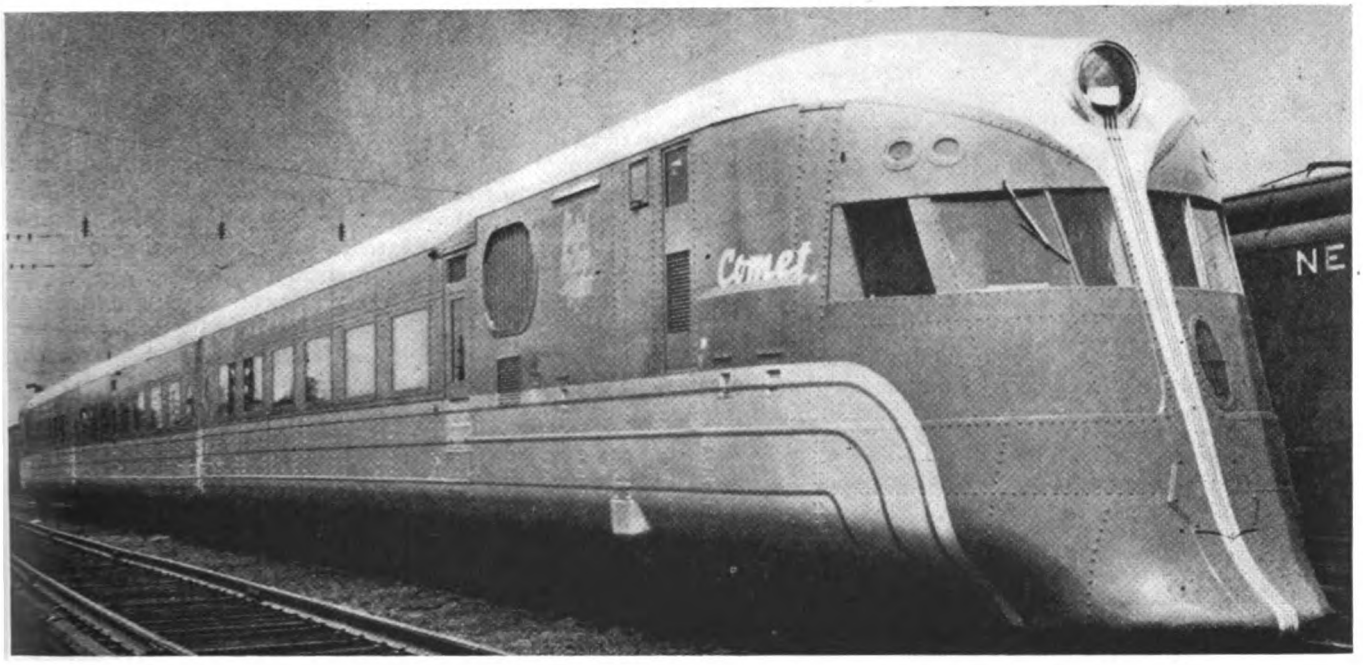


Fig. 7—Working drawing of special broach for blind keyways

cutting operations. This broach has its shank machined to the size of the keyway, with one side cut away to accommodate a broach face. At the end of the cutting operation this shank is withdrawn, leaving the broach face loose in the keyway for easy removal. Two passes must be made to cut each keyway.



The Comet, streamliner of the N. Y. N. H. & H., was selected as a proving ground for the tachometer

Tachometers for Fast Trains

By Paul MacGahan*

Requirements have been met by using an inductor type generator, rectifier and direct-current instrument

ALTHOUGH electric tachometers are well established for industrial use, adaptation to locomotives presented many special design and application problems. The type described in the following has been giving very satisfactory service on the Comet, streamliner of the New York, New Haven & Hartford.

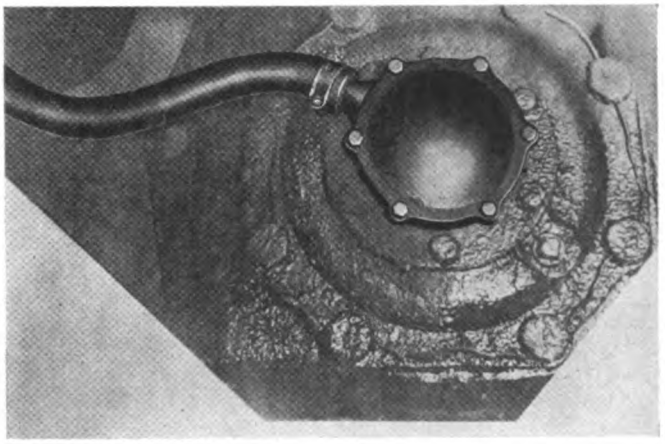
For railway use, a speed indicator must be: (1) rugged, to withstand constant pounding and vibration; (2) temperature calibrated, to be accurate under all conditions of heat and cold; (3) adaptable to axle mounting, easily removable for axle repairs or replacement; and (4) maintained easily, requiring only the type of care a railway shop affords.

As in the industrial type, the earliest forms of railway tachometers consisted of a d. c. magneto-generator having permanent-magnet fields and a delicate set of brushes operating on a miniature commutator. The output of the generator was a d. c. voltage directly proportional to speed. Delicate brushes were necessary to avoid errors due to variable contact resistance at the commutator; carbon brushes would, of course, increase such effects. These d. c. magneto-generators were electrically connected to d. c. voltmeters calibrated to read r. p. m. or m. p. h., as desired. Mounting direct on either axles or trucks, as is often necessary for locomotives, exposed the magnetos to violent vibration which tended to weaken the permanent-magnet field.

In general, voltmeters or indicators, which are mounted in the cab, have been satisfactory from the beginning. Vibration and atmospheric changes in the cab are much less violent. By using special pivots and jewels together with shock-proof mountings the instruments themselves have given good service. Thus the locomotive tachometer design and application problems have been centered in the generator, its mounting and driving mechanism.

The tachometer illustrated has recently been developed to meet the special requirements of railway applications. It is important to note that the new tachometer generator produces alternating current whereas the first types developed furnished direct current. Since all generators are basically a. c. machines (d. c. being obtained

* Meter engineer, Westinghouse Electric & Manufacturing Company, Newark, N. J.



The magneto generator as it appears when mounted on a locomotive axle

through the addition of a commutator) the need for troublesome brushes has been eliminated. Some previous a. c. magneto-generator models have utilized slip rings in place of a commutator but this did not get rid of the objectionable brushes which interfere seriously with accuracy.

The new generator design utilizes stationary coils and a rotating inductor field by means of the unique construction shown in the diagram. Coils and energizing permanent-magnets are secured in a stationary field structure and demagnetizing effects are reduced to a minimum. This is accomplished first, through use of high-coercive Alnico magnets; and second, by placing the magnets outside the influence of the magnetic pulsations produced by the teeth of the rotating armature. On the diagram, it will be noted that calibration is accomplished through adjustment of a cylindrical magnetic member. A temperature-sensitive magnetic shunt automatically compensates for the effects of heat and cold.

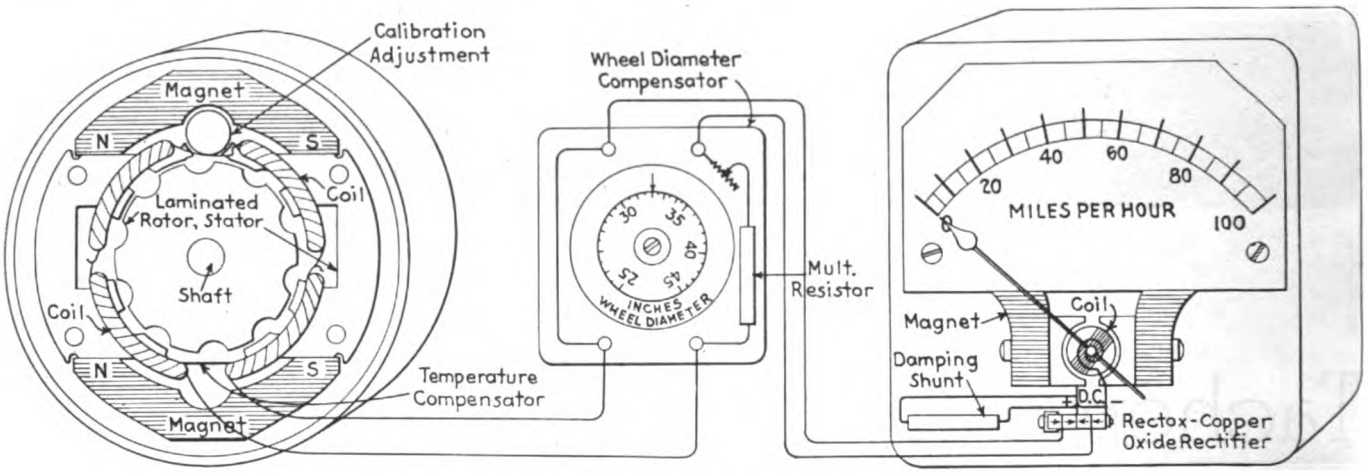
The rotating element of the generator is laminated and of tooth-type construction but carries no windings. Operating on the inductor principle, the generator is a simple sturdy machine equipped with ball bearings.

Referring again to the diagram, it will be noted that generator leads pass through a resistor box arranged to compensate for various locomotive wheel diameters. Thus wheel wear is easily taken care of through adjustment of the compensator.

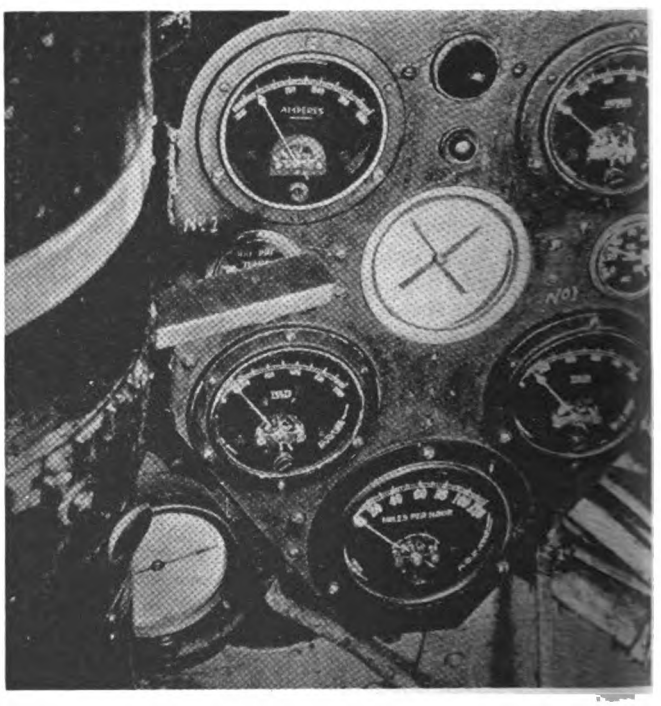
Instrument designers know that d. c. permanent-magnet instruments possess qualities entirely lacking in a. c. instruments. These qualities include sturdiness due to high torque and light weight, and high sensitivity at input power levels of .0004 watts or less; a. c. instruments of similar sturdiness require a thousand times as much input energy to overcome friction and produce proper action. Therefore a d. c. unit was selected with self-contained copper-oxide rectifier. The a. c. voltage of the generator is rectified to d. c., thus permitting use of the sensitive permanent-magnet moving-coil type d. c. voltmeter.

Mountings and drives have always presented a difficult problem in applying tachometers to railway service. Early forms involved mounting the magneto on the locomotive frame so as to reduce effects of shock and weather. This necessitated driving by means of belts or long flexible drive shafts. While satisfactory for automobiles, such methods did not prove practical for locomotives.

The new tachometer generator can be mounted either on the trucks or axles. It can be used with either friction or anti-friction journals and if desired may be driven by a rubber friction wheel which rides the periphery of a car wheel.



Schematic diagram showing the operating principle of the tachometer



A Diesel-electric locomotive instrument panel showing the speed indicating instrument at the bottom

Tips on Using War-Time Solders

Today's solder decidedly differs from pre-war solder, and so should soldering technique. Previously solder was composed of tin and lead in about 50-50 ratio; today, except for certain applications, solder contains not more than 20 per cent tin, with perhaps small amounts of silver, bismuth or antimony. Today's soldering technique calls for a hotter soldering iron, and attention to certain details. How to make better soldered joints has been explained in a communication issued by the metallurgy committee of the General Electric Company, which says:

1—Keep your work clean. Guard carefully against varnish, grease, oil, dirt, rust, or corrosion products. They prevent the flux from acting and the solder from alloying with the parent metal.

2—Keep in mind that the purpose of the soldering iron or torch is not to melt the solder but to heat the work until the solder will flow when applied to the work.

3—Keep the soldering iron clean and, to have the quickest possible heat transfer from the iron to the work, have the tip designed actually to fit against the work.

4—Investigate different methods available for doing the work—hotter electric iron, high frequency, or carbon-resistance soldering tools may do the job better.

5—Design your joints to have 0.003 in. to 0.005 in. solder thickness, and so that the two parts overlap. Lap or seam-type joints are better than butt-type joints. Have the solder fill the seam completely. Heavy fillets add little strength to the joint, and waste solder.

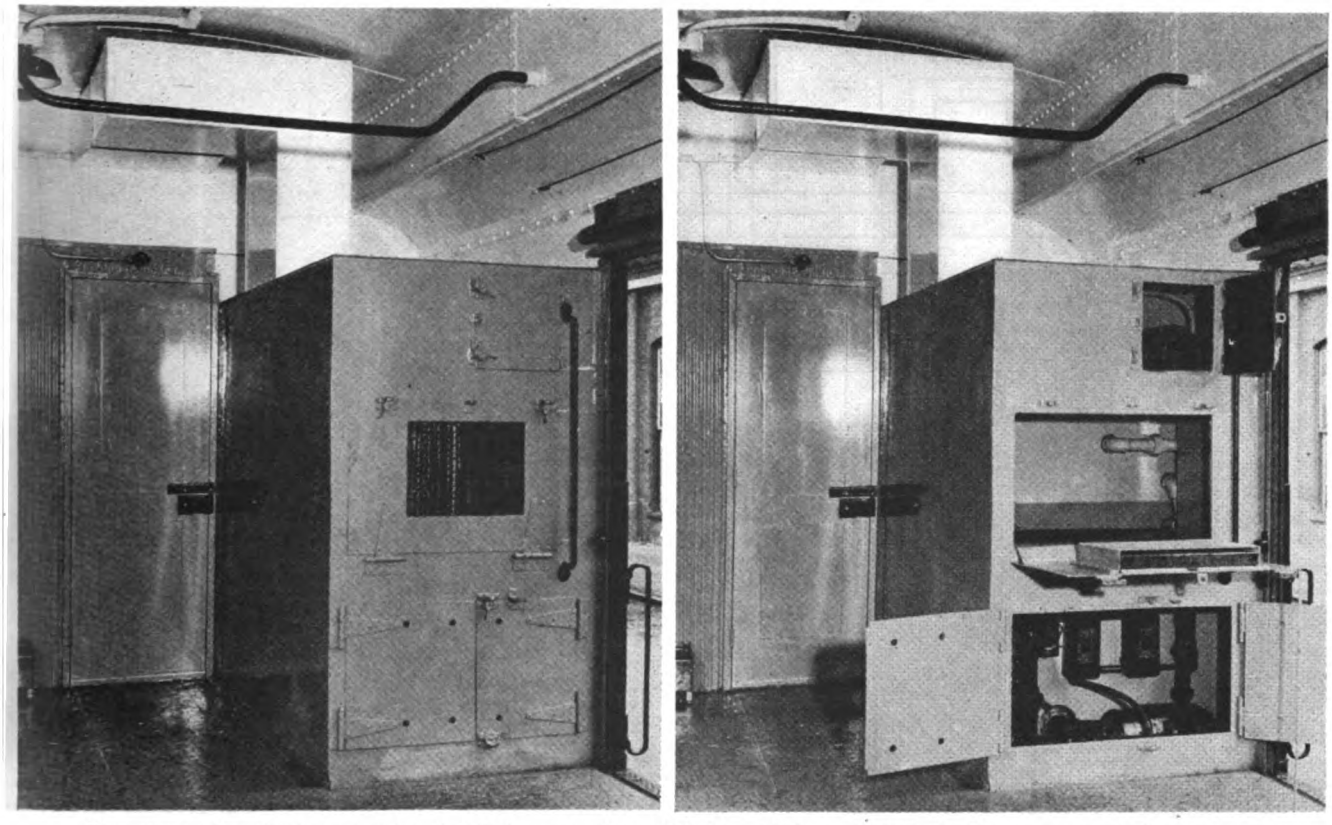
6—Don't hand a new solder, a flux, and a soldering job to a workman and expect a perfect job the first time. Let him get the "feel" of the new material. Don't give up a new solder after one unsuccessful trial—the chances are your technique is not what it should be for that particular solder.

Precoolers For Air Conditioning

The Norfolk & Western has recently installed three of its old Carrier precoolers in combination passenger-baggage cars to release the electro-mechanical air-conditioning equipment for installation on diners. This procedure has been resorted to because the railroad has not been permitted to purchase any new air-conditioning equipment.

The manner in which the precoolers were installed is shown in the photographs. Strangely, they just fitted into the spaces available as though it had been designed for them. It was not necessary to change any of the dimensions. All that was required was to cut a hole in the top of the unit to provide a discharge for the conditioned air into the duct connected to the air distribution system in the passenger end. Return air is brought back to the unit through an opening in the bulkhead which is connected to the return air opening in the cooling unit. A grille and filter are installed on the passenger side of the bulkhead in front of this opening.

The fresh air intake filter is installed in the ice bunker door. It was necessary to replace the 3-phase, 220-volt 60-cycle motors with 110-volt d.c. motors. Operating results on the cars now in service has been entirely satisfactory.



Two views of a Carrier precooler installed as an air-conditioning unit in a Norfolk & Western passenger-baggage car

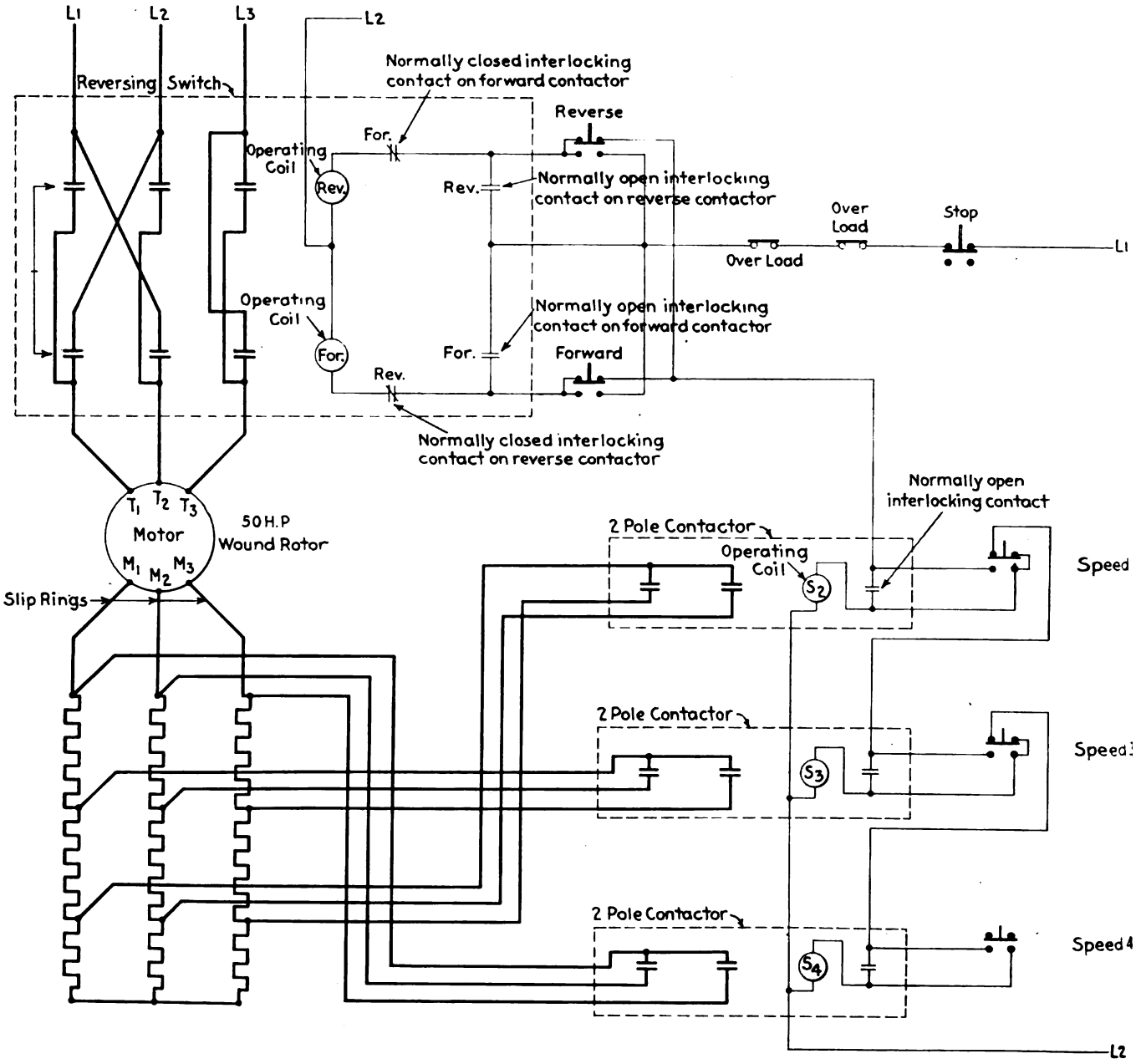
Simplified Explosion-Proof Control

Some rather astonishing economies were effected recently on the Rock Island when it became necessary to replace the explosion-proof control on a 50-hp. motor used in a grain elevator. The motor is a 50-hp., 3-phase a.c. machine of the wound rotor type. Explosion-proof controllers for such motors are not made in large quantities and by virtue of their construction are expensive. Furthermore, there were none to be had when the need arose. A search of available material disclosed that explosion-proof contactors and push button control stations could be obtained. A scheme for using these devices for motor control was worked out, as shown in the diagram, and placed in service. The push button stations and the contactors were mounted near the motor while the wound rotor resistances were placed outside the building.

From the diagram it may be seen that the operation of either the forward or reverse push button opens the No. 2, 3 and 4 contactors and starts the motor with all the resistances connected in the rotor circuit.

After the motor is started, pressing push button No. 2 will short out one-third of the rotor resistance. With contactors Nos. 3 and 4 closed, the closing of No. 2 will drop out Nos. 3 and 4. The normally open interlocking contacts corresponding to each push button stay closed when the push button is operated. Push buttons Nos. 2, 3 and 4 are normally operated in sequence to bring the motor up to speed and with the starting button provide four speeds, but if full speed is not desired for operation, any one of the others may be selected.

The cost of an explosion-proof motor control for such an installation is about $1,500. The cost of the equipment described is less than $300.



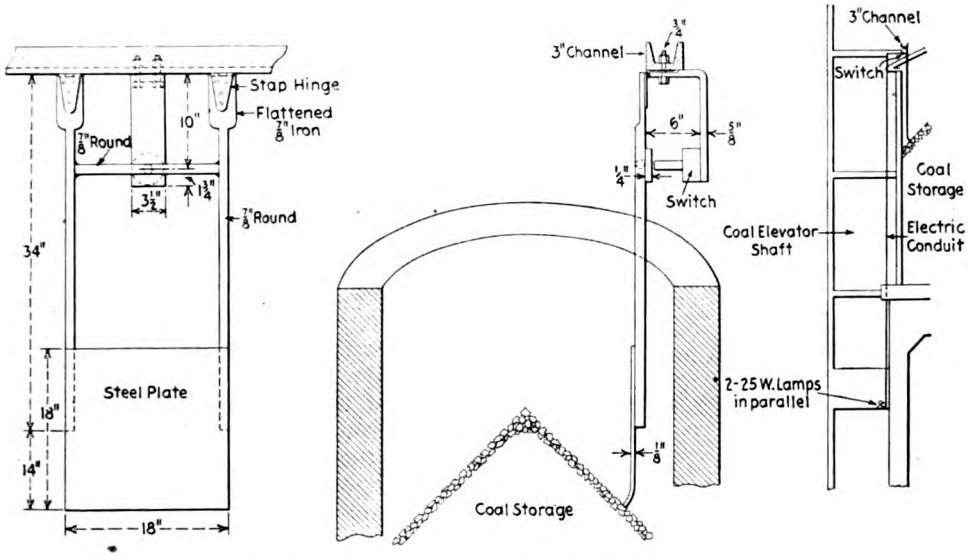
Wiring diagram for explosion-proof push-button control of wound-rotor induction motor

Full Bin Warning Device

*By S. H. Kahler**

The drawing shows a coal station contact device which operates an electric switch lighting two 25-watt electric lights located at the loading pit so that the operator is warned when the coal bin is full. The device consists of two 7/8-in. steel rods, 34 in. long, with the upper ends flattened for welding to strap hinges, and a 1/8-in. steel plate 18 in. sq. welded to the lower ends of the two 7/8-in. rods. The two rods and the plate hang as a pendulum from two strap hinges. A third 7/8-in. rod is welded 10 in. from the top for a cross support and on the center of this rod is a 1/4-in. steel plate 3½ in. sq. which makes contact with an automobile starting switch when the pendulum is swung to one side.

When the bin is nearly full, coal is forced against the large steel plate so that the small plate on the cross-support is forced against the moving element of the switch. Closing the switch makes contact to light the two 25-watt lamps at the loading pit. There is sufficient flexibility in the pendulum to avoid undue pressure on the switch; the pendulum is so arranged that when the switch is closed there is still sufficient room for eight buckets of coal (approximately 8 tons), at which time the coal runs around the sides and over the top of the plate, relieving any great increase of pressure on the switch. When coal is drawn out of the bin the pendulum swings back to a vertical position, releasing the switch and breaking contact to the warning lamps. The reason for having two lamps is to insure the operation of the signal in case one of the lamps burns out.



Details of the full bin warning device—Its location and that of the warning lights are shown on the right

* Master mechanic, The Toledo Terminal Railroad, Toledo, Ohio.

* * *



One of twenty 130-metric-ton, meter-gage, electric passenger and freight locomotives for the Estrada De Ferro Sorocabana, Brazil

Twenty locomotives like the one shown are being obtained in this country through the Electrical Export Corporation by the State of Sao Paulo in Brazil for the 207 track-miles electrification of the Sorocabana Railway. They are 3,000-volt, d.c. units; the most powerful narrow-gage type ever built. Ten of the units will be of General Electric Company manufacture, and the mechanical portions for the other ten will be manufactured by General Electric, with electrical equipment supplied by Westinghouse Electric & Mfg. Company. According to Dr. Durval Muylaert, Electrification Department of the Sorocabana Railway, electrification of the railroad will solve a serious fuel problem.

Flat Belts for Axle Drives

The rubber situation, the heavy passenger traffic and the shortage of maintenance forces have made a new problem out of an old one. What under the circumstances can be done to preserve and improve the life of flat axle generator belts?

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York, N. Y.

When a low speed machine is to be driven by an electric motor, what factors determine the type and method of drive?

What the Supervisors And Maintainers Need To Do

The question of how to improve or increase the life and service of flat car lighting belt, is one of long standing. It has taken on new angles in the past year; first and most important the rubber shortage, which unless relieved will seriously restrict the amount of belting to be applied; second, the labor situation with a great number of inexperienced men and women called upon to do this class of work, and last the enormous increase in cars in service continuously with little time in a yard for repairs.

In the past little attention was paid to belt life unless a car was chronic in belt losses, but today the problem must be faced and given serious consideration. Yard forces as well as supervisors should be made to feel they are really hampering the war effort as well as causing discomfort to passengers or men of the armed forces, by lighting and air conditioning power failures to say nothing of the increased burden on already over loaded charging facilities in the coach yards.

Close cooperation between car men and electrical repairmen can eliminate many causes of belt losses, by checking belt clearances over and under brake beams, truckend sills and belt guards. Where belts do not clear brake beams by at least one inch with brakes set and with thin brake shoes the brake beam hangers should be changed if possible to improve clearance or offset brake beam applied. This clearance should be checked as outlined for if a new brake shoe is used and clearance is close when the brake shoes wear thin, the brake beam will tear the belt off.

Generator suspensions and their alignment should be watched closely and by observing the belt path on the pulleys it is easy to locate a generator suspension that is not in proper alignment, that is to say if the belt paths on both axle and dynamo pulleys are not in the center of the pulleys either the generator is out of alignment or the axle pulley is not set correctly.

Dynamo pulleys and axle pulleys should be watched closely and if made of cast iron the crown face will wear flat, when it does the belt will slip, and face burn and the generator can not deliver full capacity. Such pulleys should be removed and recrowned before applying to another car. Where pressed steel axle pulleys are used they should be watched closely for cracks, which if allowed to progress will cut the belt faces and after a time the pulley will break and part be lost entirely; these pulleys can be welded and ground under the car without removing the pulley.

The cause of many belt failures can be laid to improper application of the belt by a workman who does not use a square or standard belt cutter when making the joints, neither does he pay any attention to how he drives the rivets, if applying that type clamp. Or if using the bolt or similar type clamp he punches his holes too close to the end of the belt or tightens the bolts so tight the slightest jar or jerk on the belt causes them to break. Also the question of belt tension must be considered and every railroad has its own requirements for it.

I personally feel that a concerted campaign by supervisors in the various coach yards going over the situation with their men and insisting that each day an effort is made to eliminate the defects on some of the most flagrant chronic belt losing equipments it will not be long until there will be a great improvement in the belt life on their cars.

JOHN V. DOBBS,
Atchison, Topeka & Santa Fe,
Albuquerque, N. M.

General Rules for Good Performance

In designing a trouble free belt drive whether on an axle generator or on a machine in the shop, there are certain important factors to consider. These factors are belt speed, average load, peak load, starting jerk and the surroundings in which the drive is to operate. The center-to-center distance of pulleys, the size and material of the smaller pulley and the position of the drive whether vertical or horizontal, top or bottom pull, even the available force of maintenance and the sizes of belt stock on hand may affect to various extents the final choice of the most suitable drive.

A brief survey of results observed during actual performance will perhaps be useful in arriving at satisfactory ways and means of preserving and extending the useful life of flat rubber belting.

Belt Capacity—Power transmission by means of a belt and two pulleys depends on the pressure existing between the belting and the pulleys. The amount of power that may be transmitted can be increased by increasing the belt tension. As the belt is stretched tighter.

the periods between belt take-ups will be relatively shorter. At extreme capacities, to which a belt should not be forced, the rate of belt stretch will be excessive and take-ups too frequent and annoying to correct. Naturally, belt life will suffer from constant stretching, take-ups and overstrain and the belt will soon fail.

Centrifugal Action—As the belt speed increases to about 5,000 ft. per min. or over, centrifugal action forces the belt away from the pulley thereby decreasing the arc of contact and pressure. Therefore, higher speed drives should have a higher standstill belt tension than recommended for lower speed drives. The bearings are relieved of this higher pressure when centrifugal force becomes effective. Around 6,000 ft. per min. belt speed, centrifugal tension is of the order of 40 lb. per in. of belt width and if the standstill tension is 40 lb. per in. of belt width, the belt cannot transmit any power at this speed. As a rule, belt speeds above 6,000 ft. per min. are not recommended unless in special cases where the pulleys are very large or circumstances so dictate. The increase in the capacity of flat belting is limited by centrifugal tension and at speeds above 5,000 ft. per min., the gain of belt capacity per unit belt speed gradually decreases.

Belt Tension—Total belt tension consists of three distinct components: the effective or working tension which transmits power, the centrifugal tension and the slack side tension which is needed to maintain belt-to-pulley grip. Belt tension should always be kept at the lowest possible point consistent with efficient driving. The belt may be loosened until it begins to slip, then, it is taken up sufficiently to carry the average load. Belt tension is practically proportional to belt thickness. This tension should also be carefully maintained with new belting which may easily stretch in a few hours or days of service, then slip and burn or come off, if not taken up in time. No effort should be made to take out all stretch at the first tightening in order to avoid overloading the bearings. Excessive tension causes crosswise fabric cracks across the belt and away from the edges and shortens belt life.

Belt Width—A wider belt will hold its tension a longer time than a narrower belt and have longer life. However, it will not pull a larger load unless a higher tension is applied. On the other hand, the amount of tension that can safely be applied is limited by the size and operating temperature of the bearings. A pulley face clearance of ½ in. to 2 in. should always be allowed on each side of a belt.

Belt Splicing—In joining the two ends of a belt with belt fasteners, great care should be exercised to cut the two ends perfectly square. A steel square may be used as a guide in cutting. Seam side is kept away from the pulley. A crooked splice causes the belt to run off the pulley, especially when the belt is slack or misalignment of pulleys exists. Defective joints should be repaired promptly. In joining the ends of rubber belting, the holes should not be too large or their number too many so as not to weaken the fabric. Also, as much space as possible should be allowed between belt ends and fastener holes to insure maximum strength.

Belt Selection—The use of endless rubber belts is preferable but naturally cannot be applied to an axle drive and cannot be used with fixed centers. When a belt is required to pull a heavier load, the better solution is a larger pulley and higher belt speed rather than a wider belt and more tension, especially when the bearings have been running at high temperatures. For a given load, a narrow and thick belt will have longer life than a wide and thin belt, if the size of the smaller pulley will permit its use. Doubling the belt thickness allows the belt tension to be doubled, but the capacity of the belt to transmit power rises to only about 170 per cent. Triple belting used where the pull of triple the tension is permissible on the bearings will transmit only about 225 per cent as much power as single belting. Capacity rating of the belt selected should be based on the average load which may include severe load peaks and not on the maximum load it will carry.

Belt Fasteners—The selection, installation and maintenance of belt fasteners is an important factor in extending the life of a rubber belt. The proper type and right size of fastener recommended for the specific belt thickness and pulley diameter should be chosen. Too large a fastener usually breaks the belt at the back of the fastener. Too small a fastener opens up and pulls out of the belt fabric. If one side of a belt fastener pulls out while in service, the belt may tear longitudinally or batter up the ends so badly that a new fastener cannot be installed without cutting off the weakened fabric.

Belt Dressing—Ordinarily, rubber belts do not require dressing. If a dressing, recommended by the manufacturer, is used, it should be applied very sparingly and only when needed. The glaze on the inside of a belt may be removed by wiping lightly with a cloth moistened with castor oil or gasoline. Excessive oily dressings cause slipping, excessive wear and are injurious to rubber. When a new belt slips, the white powder coating, if present, should be washed from the surface.

Pulley Diameter—The diameter of the pulley has an effect on the power transmitting capacity of belting. This effect is more pronounced on drives below 10 hp., and pulley diameters smaller than 8 or 10 in., partly due to the stiffness and resulting poorer grip of the belt. The use of very flexible belting will improve conditions where circumstances necessitate approach to the use of maximum belt thickness or minimum pulley diameter. However, inasmuch as the product of pulley diameter and pulley width must remain constant, the belt should be made wider in the same proportion as the diameter of the pulley is made smaller.

Pulley Crowning—Generator pulleys are crowned to keep belts operating on their center line. However, too much or too little crowning causes unstable operation. Too much crowning will reduce the power transmitting capacity of the belt and cause an undue strain along the center line, especially when improper proportioning of belt width to belt thickness exists. When the crown is greater on one side than it is on the other, the belt will shift its position as the load changes, causing uneven belt wear.

Misalignment—Misalignment of pulleys or shafts will cause side wear and fraying pulling out the edge yarns of the duck. This condition will result in narrower belts, poorer performance and shorter belt life. Old belts are sometimes stretched out of shape to conform with the misalignment of the drives and are only detected when a new belt is installed.

Maintenance—Keen observation and an understanding of the principles involved is necessary in maintaining belts intelligently. Belts should be inspected periodically and records kept of their performance in order to trace the reasons for unsatisfactory operation and to remedy in time. The most important points to check and correct are probably the following: Frayed or worn belt edges, cracks at the edge of fasteners, separating plies; traces

of oil, grease which should be washed off with yellow laundry soap and water; loose fasteners, especially shortly after installing. The outside surface of the belt should also be inspected for cracks. Remove obstructions, if any present, to prevent belt wear and grinding off of other objects. A pulley out of round will cause the belt to jump and slap, especially at high speeds.

Storing Belts—When a belt is to be taken out of service for an extended period of time, its tension should be released or, preferably, it should be removed, inspected, repaired and stored away. The surface should be scraped with a brush or scraper and cleaned. The fasteners should be checked. The belt should then be rolled, tied, properly identified with a tag and stored in a dark, cool and dry place.

R. G. CAZANJIAN

Capacitors

A Correction

The author has called attention to two errors which appeared in the article, "An Ammeter and a Voltmeter Will Tell the Story", which appeared on page 385 of the August issue.

"Near the bottom of the first column, in the expressions for the current I, the constant 1,000 should be in the numerator instead of the denominator, that is, $I = \frac{kva.}{E} \times 1{,}000$, and $I = \frac{kva.}{1.73E} \times 1{,}000$, respectively. These are simple well-known formulas and no doubt many readers will comment on this typographical error on my part.

"The other error is at the top of the second column and is not so obvious without a little thought. The kva. varies as the square of the voltage as stated, so a capacitor rated at 230 volts but operating on 260 volts would furnish a reactive leading kva. about 28 per cent greater than its nameplate reading. (Incidentally the parenthesis in the sixth line, second column, should be around the entire expression instead of just the numerator.) Thus its current if computed from the rated voltage would appear to be 28 per cent larger. In the example the voltage was taken as 13 per cent above the nameplate rating which made the kva. $(13)^2$ or 28 per cent larger.

When this 28 per cent larger kva. is divided by the 13 per cent larger voltage it is seen that the current would be 13 per cent above normal. This is obvious since the impressed voltage does not alter the capacitance (i. e., impedance) of the condenser and from Ohm's law, the current is directly proportional to the voltage. Starting at the bottom of the first column, the article should read: 'As can be seen from the formula, the kva. varies as the square of the voltage. Dividing the expression for kva. by the voltage we see that $I = 2\,fCE$, or that the current varies directly as the voltage impressed. For example, if a capacitor is rated at 230 volts, and the voltmeter indicates an applied voltage of 260 volts, the ammeter should show a current flowing of $\frac{260}{230}$ or about 13 per cent greater than rated normal current.'"

Blocking Commutators

We make a practice of "blocking" our Diesel-electric locomotive generator commutators after each run. This consists of scrubbing them with a canvas-covered block curved to fit the surface of the commutator. It does not remove the glaze but it does clean them; and when treated in this manner they seem to require no other maintenance. Can you suggest any way in which we can similarly retain a good commutating surface on our traction motors?

Corrective Measures May Make It Unnecessary

The practice of jacking up drivers and running motors on first notch for the purpose of occasional stoning of commutators is recognized practice on some railroads but it is questionable if this would be a practical procedure to follow for "blocking" or "wiping" as this requires frequent application to be effective.

A more direct approach to the problem, assuming that the equipment is adequate for the job, is to determine what factors make such frequent attention necessary and apply corrective measures where possible, such as selection of proper brush grades, spring pressure, elimination of dirt, oil or abuses contributing to faulty commutator surface.

J. W. TEKER,
Transportation Motor Engineering Department
General Electric Company
Erie, Pa.

* * *



Joe Lucky, a veteran of 38 years service with Westinghouse, taps into place an armature coil on a 150-hp. motor being built for a Diesel-electric locomotive

NEW DEVICES

Furnace for Heat Treating Tools

The Mahr Manufacturing Company, Minneapolis, Minn., has added a gas-fired muffle-type tool furnace designed for use in machine shops and tool and die shops to the other types of heat treating equipment manufactured by it. The furnace employs a "Diamond" block for charge protection which is a carbonaceous box in which pieces to be hardened are placed. The entire assembly is then placed within the furnace. The "Diamond" block provides the protective atmosphere required for bright, scale free hardening. Fluxless brazing may also be done in the furnace.

Electronic Bearing Alarm System

A device for automatically measuring bearing temperatures and for indicating a rise above predetermined values is now being offered by the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. These devices applied to the journals of Diesel-electric locomotives have been under road test in actual railroad operation for about a year and are being applied to additional locomotives.

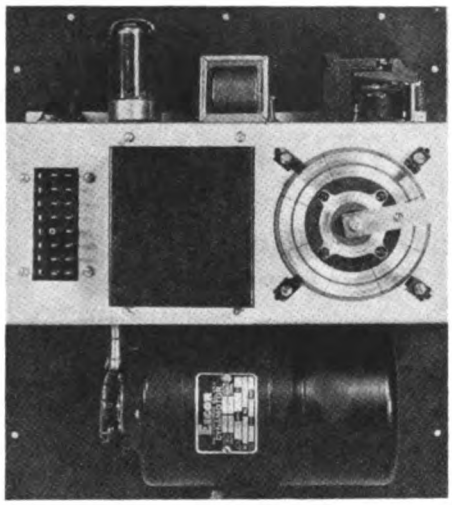
The system consists essentially of a temperature element applied to each bearing with a connection to a control box in



Front view of the control cabinet showing indicator lights

the locomotive cab. A motor-driven selector switch shown in one of the illustrations serves to connect each couple progressively with the temperature measuring element in the control box. Should the temperature in any bearing exceed the predetermined value, a lamp on the control box corresponding to that bearing will light and an alarm bell will sound. The light will remain lighted and the selector switch will stop. The light may be extinguished by manual operation of a reset switch, or by reducing the temperature of the bearing through the addition of oil, reduction of speed, or other means.

If desired, the temperature of any bearing can be determined at any time by means of a manually-operated switch. Temperature measurement is accurate to within plus or minus 5 deg. F. On the systems



Back view of the cabinet panel with the cover removed from the motor-driven selector switch

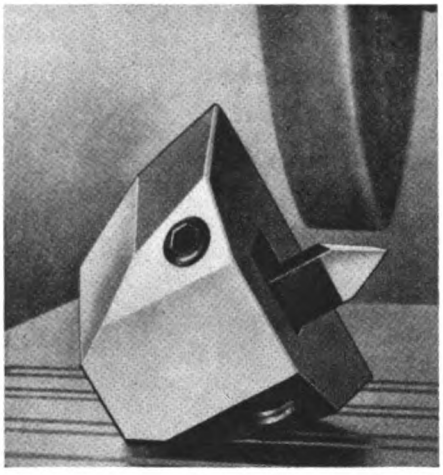
now in service the motor-driven selector switch is operated at a speed which will check the temperature on each individual bearing once each minute. The alarm point is set as low as possible consistent with running temperatures, usually about 180 deg., so that the alarm will ring soon enough on a temperature rise to permit the train crew to take corrective action before a critical temperature is reached. For example, if the melting point of the babbitt in a friction type bearing is 350 degrees, a warning that the temperature of that bearing was rising, given at 180 deg., is usually soon enough to allow the train crew to take necessary measures to cool the journal bearing before the bearing surfaces are damaged. The same procedure is applicable to anti-friction bearings except that the temperature alarm point will be higher. The presence of an open circuit, short circuit or grounded circuit is indicated automatically and in such a case the temperature element in that particular journal is cut out and protection retained on the others.

Power for operating this device is obtained from the 32- or 64-volt battery circuit on the locomotive and the power consumption is 30 watts. A small self-contained motor generator set converts this d. c. supply to a. c. for the temperature measurement system. The cabinet which contains all the equipment except the thermocouples measures 12⅜ by 13¼ by 8¼ in. The thermocouples applied to bearings are 3⅜ in. long by ⅝ in. in diameter and will fit into any standard journal casting. Other shapes and sizes of temperature elements designed for a number of different types of temperature measurements are also available.

The equipment now applied to Diesel-electric locomotive journal bearings is also offered for measuring and signaling temperatures of cylinder walls, Diesel or steam, main engine bearings, traction motor bearings, cooling water, lubricating oil, exhaust gases on locomotive and similar equipment is available for bearings on steam locomotives and passenger cars.

Thread Tool-Grinding Fixture

A thread-tool grinding fixture for grinding both 60 deg. and 29 deg. threading tool bits is being manufactured by the Robert H. Clark Company, 3434 Sunset boulevard, Los Angeles, Calif. The fixture has no graduated scales or moving parts; a machinist slides the bit into the holder, tightens a setscrew and places the fixture on the grinder work table properly posi-



Grinding fixture for use in dressing threading tool bits

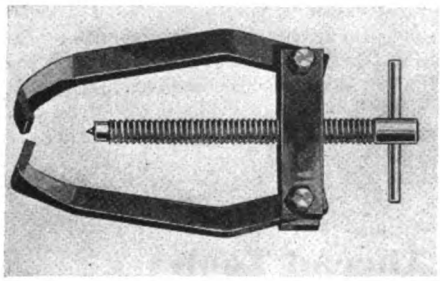
tioned for the thread angle desired as indicated on the fixture. The bit is then held securely at the desired angle to the grinding wheel.

The fixture is adaptable for use with a magnetic chuck although if desired it can be clamped to the work table. Special tool bit holders will hold round or square tool bits of all sizes from ⅛ in. to ⅝ in. for cutting both right and left-hand threads. Correct side clearance is provided for and all bits may be ground with or without rake on the cutting face. The fixture may

be used on any surface grinder or cutter grinder and is available in two standard sizes, each of which takes all tool bits within a ⅛ in. to ⅝ in. range. One model is designed for the mechanic's tool kit; the other is a heavy-duty shop model.

Puller for Electrical Work

A bearing and battery terminal puller known as Steelgrip is announced by Armstrong-Bray & Co., Chicago. It is made in



The puller may be used for either bearing or battery terminals

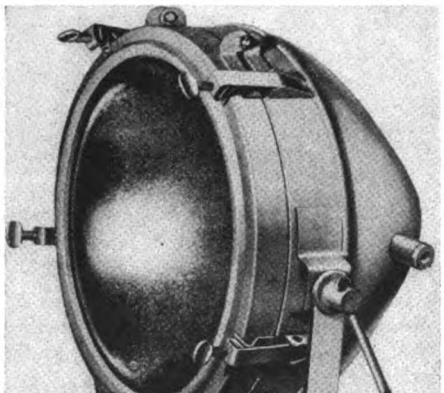
two sizes, Nos. 13 and 13A, having 2-in. and 5-in. reach, respectively. The arms are made of drop forged, heat-treated steel. To allow for its use as a bearing puller, the hooks are made thin enough so that they will fit between bearings and motor housings, and long enough to reach the bearing race.

Directable Floodlight

A 500-watt floodlight now being made by Revere Electric Manufacturing Company, Chicago, has a mounting which permits directing the beam to any desired angle. It is designed for rugged service, built to withstand concussion, vibration and exposure to sea atmosphere. The housing is of heavy gage spun steel.

The lens door frame is hinged on widely spaced supports and is fitted with wing screw latches to insure alignment and accurate compression on the gasket to form a tight seal between the glass and the housing. The glass reflector is accurately formed and a high co-efficient of reflection is obtained by chemically deposited silver on the back. The reflecting coating is backed up by a second coat of silver applied by an electrolytic process. These completed silvered surfaces are protected by a fired enamel backing permanently sealing the silver between two thicknesses of glass. The reflector can be subjected to a temperature of 570 deg. F.

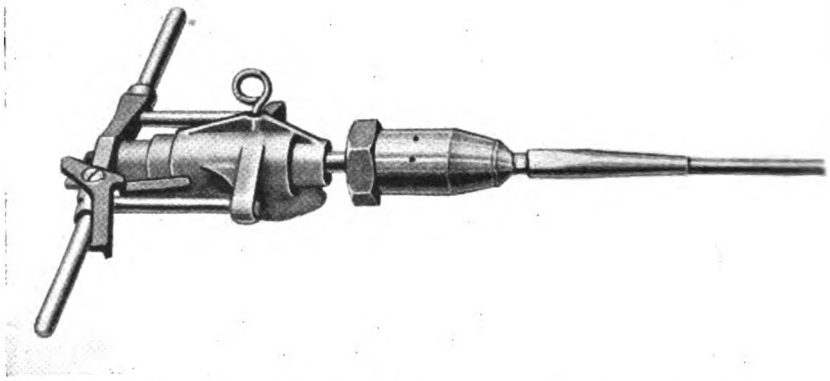
The floodlight rotates on a trunnion allowing 360 deg. horizontal rotation and the yoke permits unlimited vertical adjustment. It may be locked in any position.



Revere No. 5701 controlled-beam floodlight

High-Speed Tube Cleaner

A tube cleaner designed to operate at high speed in the cleaning of small diameter tubes is being manufactured by Thomas C. Wilson, Inc., 21-11 44th ave., Long Island City, N. Y. It is designed primarily for the cleaning of tubes of from ⅜ in. to 1¼ in. diameter such as are used in condensers, heat exchangers and similar equipment. A "cutter-bit" is said to be effective in removing soft, gummy or moderately hard deposits quickly and at minimum cost. In some cases the removal of the tubes from the shell is not required. An additional attachment to the "cutter-bit" can be used on especially hard deposits which combines the movement of the rotary tube cleaner with a hammering action which tends to break down scale deposit and enables the bit to obtain a "bite" on the deposit. This attachment is operated by the air or steam used as a scavenging agent in the tube cleaner and aids greatly in the cleaning of partially or totally plugged tubes.

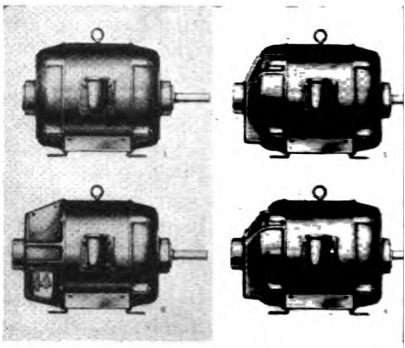


Tube cleaner which operates at high speed and with special attachments, removes hard sc deposits

Uni-Shell Motors

Robbins & Myers, Inc., Springfield, Ohi has announced a line of Uni-Shell electr motors in which all motor types in any o frame size are interchangeable.

All motors are built within cylindric shells of steel. In any one frame size t



Only the end heads are different on the rious types of motors—those shown are p phase induction, capacitor start, single-p induction, direct current and repulsion ind tion motors

shell dimensions, head fit, bolt circle ho shaft size and conduit box mountings identical for all motor types. This is t of polyphase induction motors, capaci start induction motors, standard d.c. mot and generators, repulsion induction moto as well as other types.

All ball bearing motors are fitted w double-row-width ball bearings which h an exceptionally large grease reservoir, a complete seals on both sides that are h in place by removable snap rings. T lubricant is sealed in and the dirt seal out. Improvements have also been ma on sleeve bearings for Uni-Shell moto requiring them. Cast bronze bearing with surfaces burnished, are used on bo wool-packed and ring-oiler types.

Impregnated rag paper is used for sl insulation. The wire itself is coated wi double-weight synthetic resin insulation f strength, toughness and flexibility. A added sheet of impregnated paper is plac between the coils in the slot and comple insulating paper protection can be us between the phase groups in the windin

The entire winding assembly is given successive cycles of pre-heating, dipping in special synthetic resin-base varnish, and baking. As a final protection, the coils are covered with moisture-resistant synthetic resin and tung oil sealer. Precision balancing prevents vibration.

A. C. Welder

Harnischfeger Corporation, Milwaukee, Wis., announces the addition of a complete line of industrial a.c. arc welders to its present line of d.c. machines. The a.c. machines are being made in heavy duty



P & H heavy duty 100- to 625-amp. a.c. welder

and four intermittent duty models. Welding service-range ampere ratings, which show the actual minimum to maximum output of usable welding current for heavy duty models are 50 to 270, 60 to 375, 90 to 500, 100 to 625, 125 to 750, 150 to 900, and 200 to 1,200. Intermittent duty model ratings are 20 to 185, 20 to 235, 20 to 285, and 20 to 335. Setting and control of current throughout the service range involves only one adjustment. According to P&H engineers, the control is creep-proof and machine efficiencies as high as 95 per cent are obtained.

Outdoor Photoelectric Relay

A general-purpose photoelectric relay for outdoor use has been announced by the Electronic Control Section of the General Electric Company, Schenectady, N. Y. Its contacts control 2 amp. at 115 volts, 25- to 60-cycles, alternating current, or 0.5 amp. at 115 volts, direct current.

The amplifier tube has a filament which operates on full line voltage, eliminating the need for a filament transformer; it



The relay may be used for counting, controlling or limiting operations

incorporates a diode rectifier which functions when a.c. power supply is used.

The relay's weatherproof case is equipped with a sun shield and a large, directional lens system to minimize the effect of slanting sun rays. In addition, the lens system increases the relay's sensitivity.

The relay can be mounted in any position and can be adjusted under actual operating conditions, without removing the cover. The chassis can be removed from the case for inspection or servicing or, if desired, for mounting with other apparatus in a combination enclosure.

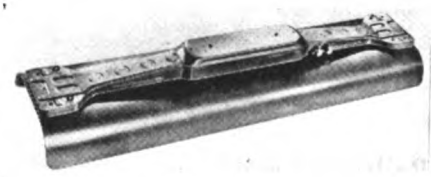
Release Table For Diesel Truck Removal

A shallow pit release table to be used in removing trucks from Diesel-electric locomotives is being manufactured by the Whiting Corporation, Harvey, Ill. The table is similar in design to older types built by this company except that side deck flooring has been removed and the table has shortened wheelbase. The elimination of the flooring facilitates inspection of the trucks and the shorter pit makes the unit available where there is little floor space.

The table is equipped with four flange wheels riding on two pit rails. Anti-friction bearings allow easy hand racking by the operator who stands in the pit. In removing trucks the locomotive is run over the table where the truck to be removed is spotted; the locomotive is jacked up to a sufficient height to permit the truck to be shifted sidewise to an adjoining release track where it is dismantled. The table has a capacity of 100 tons.

Fluorescent Lighting Fixtures

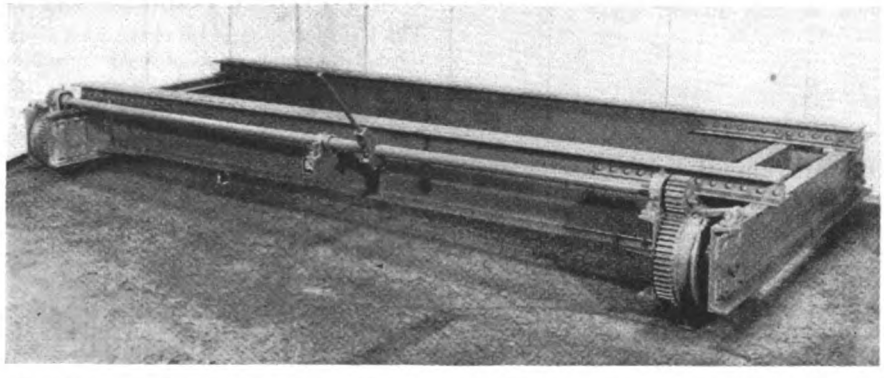
Sylvania Electric Products, Inc., Ipswich, Mass., presents an industrial fluorescent lighting fixture which meets the latest critical material weight requirements of the War Production Board. The first unit designed to operate two or three 40-watt lamps will be followed by a compan-



Top view of fixture showing location of auxiliary unit housing

ion unit for a pair of 100-watt fluorescent lamps. The non-metallic reflector, finished on the outside in industrial French grey to match the top-housing, has a reflecting surface of Sylvania's Miracoat which makes it more efficient than porcelain enamel on steel.

The reflector is actually anchored to the top-housing with a pair of captive latches which release with a simple quarter-turn and lock with a strength sufficient to support more than 20 times the weight called for in service. Chain hanging ears on 43-in. centers, ½-in. knockouts on 18-, 24-, 30- and 36-in. centers, channel for adjustable slide-grip hangers, and knockout for levolier pull chain switch make installation speedy and economical. All fixtures come complete, ready for installation, including lamps and starters. There are hanging accessories for various industrial uses.



This table can be installed in shops having limited available floor area and permits ready inspection and removal of trucks from Diesel-electric locomotives

High Spots in
Railway Affairs . . .

Bravery Under Fire

Brig. Gen. Carl R. Gray, director general of the Military Railway Service in North Africa, has cited the 727th Railway Operating Battalion for its outstanding accomplishments in the operation of railway lines in the Tunisian campaign during the first four months of this year. Several specific instances are cited of unusual performances under fire. This battalion is officered largely by men from the Southern Railway, Lt. Col. Fred W. Okie, formerly superintendent of the Birmingham division of the Southern, being in command. Colonel Okie was awarded the Legion of Merit last April.

Railroad Employees Lacking in Courtesy

The marketing research department of the advertising firm Henri, Hurst & McDonald, Inc., of Chicago, recently secured the opinions of 120 industrial executives in 50 cities and 17 states, on what the railroads should do to improve public good-will toward them. The most frequently recurrent thoughts were the desirability of inculcating greater courtesy on the part of the employees and the advisability in current railroad advertising of telling more about what the carriers propose to do toward improved postwar service. About 80 per cent of these business men indicated that they were aware of the limitations the railroads suffered in securing new equipment. As to what should be done to improve wartime passenger service, the suggestions most frequently made were (1) restrict service to essential travel; (2) insist on courtesy; (3) add more trains where equipment is available; (4) dining car service badly in need of attention; (5) increase and improve ticket selling facilities and the handling of reservations.

Ore Movement on Lakes

The iron ore movement on the Great Lakes got off to a bad start this year because of the late opening of navigation. The War Production Board set an unusually high goal because of our war necessities. Fortunately a new record was achieved during the month of July and the greatest single month's movement in history was recorded —13,588,814 gross tons. New vessels being built under the Maritime Commission are being added to the fleet and unless unfavorable weather or an unusually early winter is encountered, it is hoped that the season's movement will meet the War Production Board requirements.

High School Boys Used on Track Work

More than 1,300 high school and preparatory school boys have been employed on track work this summer by the Chicago, Milwaukee, St. Paul & Pacific. Some of these boys were lined up for week-end work before the summer vacation began. Division officers first approached the school authorities, advising them of the need for manpower and explaining clearly the nature of the work to be done and the working conditions. In order to insure proper supervision of the boys in the camps and while at work, athletic coaches from the local high schools were employed to live and work with them. They were paid the prevailing rate of extra gang laborers or section men for eight hours, and time and a half for overtime. In training them, special stress was placed upon safety, with the result that reportable injuries were fewer among the boys, in proportion to their number, than among the older trackmen. In some instances they were transferred to and from work daily on motor cars and trailers, or buses. In still other instances they lived in camps, arranged exclusively for their use. The boys were employed largely in spot tie renewals, spot surfacing and in general track raising and surfacing operations.

Heavy Freight Traffic

The transportation of oil to the East Coast, the all-rail movement of coal into New England, the handling of traffic diverted from the Panama Canal, the hauling of raw sugar from the Gulf Coast to the eastern refineries, and the carrying of vast amounts of material for our war operations, have greatly increased the freight traffic on the railroads. For the early months of this year, for which ton-mile statistics are available, it has much more than doubled that for the same months in 1939. In commenting on this at the mid-summer meeting of the A. S. C. E., Dr. Carson S. Duncan, economist of the A. A. R., pointed out that the hourly output of transportation by the average freight train was 20 per cent more in 1942 than in 1939; the average freight car went 22.5 per cent further per day and was loaded 18.2 per cent heavier. The average freight locomotive also turned in 17.7 per cent more mileage a day. The railroads are today receiving considerably less for hauling a ton of freight one mile. In 1942 the average revenue ton-mile was only 0.932 cent, as compared with 0.973 cent in 1939.

Grain Movement Successful

Grain from the southwest has been moved to points of storage and consumption with a minimum of delay and complaint and without serious car shortages. Several factors are responsible for this good showing. More storage space was available this year than in 1942; last year's bumper crop was reduced this year to one of ordinary size because of unfavorable weather conditions; the so-called permit system helped to control the flow of grain. The railroads, geared up to war requirements, took unusual steps to meet the demands upon them, and they were materially assisted by the co-operative spirit of not only the shippers but also the receivers of the grain.

Four-Fold Increase In Passenger Traffic

For that part of this year for which the records are available, passenger traffic handled by the railroads has increased almost four-fold, as compared to the same months in 1939. Speaking before a meeting of the American Society of Civil Engineers at Los Angeles, Cal., Dr. Carson S. Duncan, economist of the Association of American Railroads, declared that this was accomplished with 28,478 passenger cars, including Pullmans, or about 150 fewer than were operating at the end of 1939. Military traffic in special trains and special cars, alone, accounts for approximately 20 per cent of the total passenger-miles of the railroads. The average mileage per passenger locomotive per day in 1942 was 206.8, an increase of 12.3 per cent over the 1939 record. In spite of the great increase in both passenger and freight traffic, which tends to slow down operations, the average passenger train speed in 1939 of 36.9 miles per hour between terminals, did not decrease.

Among the Clubs and Associations

Welding Society to Hold Railroad Session

A SESSION devoted to the consideration of the use of cutting and welding in railway locomotive and car construction and repair will be held in connection with the annual meeting of the American Welding Society during the week of October 17. Convention sessions are being held at the Hotel Morrison, Chicago. The railroad session will be held on Monday afternoon, October 18 at 2:00 p.m. and the program includes papers on the following subjects: The Welded Locomotive Boiler, by E. G. Young, University of Illinois; Welding As It Applies to Railroads, by Robert Moran, Missouri Pacific; Railroad Shop Welding and Cutting, by J. W. Kenefic, Air Reduction Sales Co.; and Welding of Railroad Transport Equipment, by C. Dreutzler, Electro-Motive Corp.

A. G. Oehler, electrical editor, *Railway Mechanical Engineer*, will preside as chairman of the session and the vice-chairman will be C. E. Morgan, superintendent of work equipment and welding of the Chicago, Milwaukee, St. Paul & Pacific.

Car Department Officers Plan Year's Work

AT a recent meeting of the board of directors and the general committee of the Car Department Officers' Association at Chicago, H. P. Allstrand, chief mechanical officer, Chicago & North Western, was elected a member of the board in place of E. B. Hall, retired, and J. A. MacLean, Jr., president, MacLean-Fogg Lock Nut Company, Chicago, was made a member of the board in place of J. W. Fogg, long associated in various executive capacities with the same company. The work of the Car Department Officers' Association was lined up for the coming year and it was decided that, although no annual meeting will be held this fall, committee reports will be prepared as usual and published in a book of 1943 proceedings the same as in previous years.

The subjects selected for consideration in 1943 reports, and approved by the A. A. R. Mechanical Division, also the committee assignments, are as follows:

REPAIR METHODS AND SHOP KINKS (INCLUDING TOOL MAINTENANCE)

R. K. Betts (chairman), foreman car repairs, Pennsylvania, East St. Louis, Ill.

R. P. Dollard, shop engineer, Chesapeake & Ohio, Richmond, Va.

H. F. Lyons, acting superintendent car department, Reading, Reading, Pa.

W. J. McCloskey, general car foreman, Illinois Central, Centralia, Ill.

P. B. Rogers, shop superintendent, Atchison, Topeka & Santa Fe, Wichita, Kan.

V. J. Huff, assistant master car builder, Chicago & Eastern Illinois, Danville, Ill.

J. E. Fitzgerald, assistant master mechanic, New York, New Haven & Hartford, Boston, Mass.

PASSENGER SHOP AND TRAIN YARD OPERATION IN THE PRESENT EMERGENCY

C. P. Nelson (chairman), assistant superintendent car shops, Chicago & North Western, Chicago.

K. H. Carpenter (vice-chairman), superintendent car department, Delaware, Lackawanna & Western, Scranton, Pa.

F. A. Shoulty, assistant superintendent car department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.

C. E. Pence, general foreman, Chicago, Rock Island & Pacific, Chicago.

J. M. Thommen, car foreman, Pennsylvania System, Chicago.

T. F. Lahiff, coach yard foreman, Chicago, Burlington & Quincy, Chicago.

G. R. Jackson, general car inspector, International Great Northern, Houston, Texas.

F. H. Becherer, superintendent car department, Baltimore & Ohio, Baltimore, Md.

J. P. Jangro, superintendent car maintenance, Boston & Maine, Boston, Mass.

LUBRICANTS AND LUBRICATIONS (PACKING AND SERVICING JOURNAL BOXES)

J. R. Brooks (chairman), supervisor lubrication and supplies, Chesapeake & Ohio, Richmond, Va.

G. H. Johnson, general car foreman, Chicago, Great Western, Oelwein, Ia.

W. G. Aten, mechanical inspector, Chicago, Burlington & Quincy, Chicago.

W. E. Campbell, general car department, supervisor, Chicago, Milwaukee, St. Paul & Pacific, Tacoma, Wash.

John B. Flynn, district manager, Texas Company, New York.

L. D. Grisbaum, service engineer, Railway Service & Supply Co., Indianapolis, Ind.

J. M. Holt, general car inspector, Southern Pacific, San Francisco, Calif.

W. J. McGee, service engineer, Galena Oil Company, Atlanta, Ga.

M. J. Mills, general car inspector, Pere Marquette, Grand Rapids, Mich.

F. G. Moody, master car builder, Northern Pacific, St. Paul, Minn.

Gerald O'Keefe, special mechanical inspector, New York, New Haven & Hartford, New Haven, Conn.

T. W. Potter, service engineer, Journal Box Servicing Corp., Indianapolis, Ind.

J. A. Rippberger, general car foreman, Illinois Central, Freeport, Ill.

FREIGHT CAR INSPECTION (AND MAINTENANCE TO COMPLY WITH A. A. R., MECHANICAL DIVISION, GC-1006 COMMITTEE INSTRUCTIONS)

H. E. Wagner (chairman), master car builder, Alton & Southern, E. St. Louis, Ill.

H. J. Baker, inspector car department, Pere Marquette, Grand Rapids, Mich.

T. S. Cheadle, chief car inspector, Richmond, Fredericksburg & Potomac, Fredericksburg, Va.

F. B. Demarest, division general car foreman, New York Central, Mattoon, Ill.

O. R. Donoho, assistant general car foreman, Florida East Coast, St. Augustine, Fla.

M. Engeln, general freight car foreman, Chicago & Eastern Illinois, Danville, Ill.

J. T. Gaghen, general car foreman, Illinois Terminal, Federal, Ill.

William Hartnett, general car foreman, Chicago & North Western, Chicago.

D. A. Reavis, general foreman car department, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

INTERCHANGE AND BILLING FOR CAR REPAIRS

E. G. Bishop (chairman), general foreman car department, Illinois Central, East St. Louis, Ill.

D. E. Bell (vice-chairman), A. A. R., Canadian National, Winnipeg, Manitoba, Can.

W. J. Burns, mechanical inspector, General American Transportation Corp., Chicago.

F. McElroy, chief clerk, vice-president, Union Tank Car Company, Chicago.

C. A. Erickson, general A. A. R. inspector, Chicago & North Western, Chicago.

M. E. Fitzgerald, master car builder, Chicago & Eastern Illinois, Danville, Ill.

C. W. Kimball, assistant supervisor car inspection, Southern, Atlanta, Ga.

F. J. Larrisey, chief A. A. R. inspector, Erie, Cleveland, Ohio.

J. E. Mehan, assistant to superintendent car department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.

R. W. Hollon, mechanical inspector, Chicago, Burlington & Quincy, Chicago.

F. Peronto, assistant to secretary, A. A. R., Mechanical Division, Chicago.

C. R. Weigmann, chief interchange inspector, St. Louis-E. St. Louis, East St. Louis, Ill.

H. C. Argart, superintendent, St. Louis Refrigerator Car Co., St. Louis, Mo.

LOADING RULES

E. N. Myers (chairman), chief interchange inspector, Twin City Joint Car Inspection Association, St. Paul, Minn.

H. T. DeVore, chief interchange inspector, Youngstown Car Inspection Association, Youngstown, Ohio.

H. H. Golden, supervisor, A. A. R. interchange and accounting, Louisville & Nashville, Louisville, Ky.

L. T. Donovan, A. A. R., Mechanical Division, loading inspector, Pittsburgh, Pa.

T. E. Hart, supervisor of loading and interchange, New York, Chicago & St. Louis, Cleveland, Ohio.

W. P. Elliott, general car foreman, Terminal Railroad Association of St. Louis, E. St. Louis, Ill.

S. C. Montgomery, general car foreman, Illinois Central, Memphis, Tenn.

W. A. Emerson, general master car builder, Elgin, Joliet & Eastern, Joliet, Ill.

F. Cebulla, general car foreman, Great Northern, St. Paul, Minn.

N. Arnold, general car foreman, Missouri Pacific, Kansas City, Mo.

A. A. R. PAINTING RULES (INTERIOR AND EXTERIOR FREIGHT-CAR PAINTING)

L. Hartz (chairman), foreman painter, Illinois Central, Burnside Shops, Chicago.

Harry Stahnke, general painter foreman, New York Central, Albany, N. Y.

N. J. Early, general passenger car foreman, Missouri Pacific, St. Louis, Mo.

R. Middleton, foreman painter, New York, Chicago & St. Louis, Chicago.

Edward Driscoll, foreman painter, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.

W. F. Schwenk, foreman painter, Missouri Pacific, Sedalia, Mo.

D. J. Watson, foreman painter, Great Northern, St. Paul, Minn.

Robert Woods, master painter, Grand Trunk Western, Port Huron, Mich.

NEWS

Manpower Commission Concedes Maintenance Essential

AMONG important changes in the listings of essential occupations issued by the War Manpower Commission to guide local draft boards in their consideration of deferments which were announced early last month was the inclusion of "maintenance and repair of railroad equipment, building, right-of-way, and rolling stock" in the group of preferred occupations. The directions were contained in Bulletin 26-3.

In this connection it was again emphasized that such bulletins are not orders for deferment of men engaged in the occupations listed as essential. In each case it is the responsibility of the local board to determine that the individual registrant is a "necessary man" in his particular occupation, it was explained, and the purpose of the listings is primarily to indicate what occupations are considered to be essential to the war effort.

Fourth Quarter Steel Allotments Larger

THE War Production Board's Requirements Committee has allocated to the transportation industry 1 380,000 tons of carbon steel for the fourth quarter, an increase of 180,000 tons over the 1,200,000 tons allocated for the third quarter. This was appraised as a "substantial increase" in an August 9 announcement from the Office of Defense Transportation which is claimant agency for transportation under the WPB's Controlled Materials Plan. ODT had asked for an allotment of 1,590,000 tons.

The ODT statement said that the amount of material sought for the fourth quarter for the production of locomotives, freight cars, buses, street cars, trucks, and trailers was granted, while material was also provided for a number of tugboats, towboats and barges. This means that the cessation in freight-car production feared after the announcement of the third-quarter allocations will not come to pass.

The fourth-quarter allocation contemplates steel for an additional 9,500 freight cars, although most of them will not be completed until early in 1944.

Meanwhile, however, ODT had found it possible to provide for the production of an additional 5,801 new cars this year out of the steel allocated for the third quarter but not used for its original purpose. This was made known in an August 11 announcement which pointed out that the 1943 production will thus total "upwards of 32,000 new freight cars," i.e., the 26,000 originally authorized, plus the 5,801, plus such portion of the fourth-quarter's 9,500 that may be completed before the end of the year.

The breakdown of the 5,801 by types is as follows: Box 2,724; gondola, 262; hopper, 2,150; refrigerator, 300; flat, 365. They will be built by American Car & Foundry Company, 1,402; Bethlehem Steel Company, 500; Fruit Growers Express Company, 300; General American Tank Car Company, 1,100; Greenville Steel Car Company, 165; Mather Stock Car Company, 62; Mount Vernon Car Manufacturing Company, 200; Pullman-Standard Car Manufacturing Company, 1,092; Chicago, Milwaukee, St. Paul & Pacific shops 300; Chicago, Burlington & Quincy shops, 330; Reading shops, 200; St. Louis, Southwestern shops, 150.

In addition to the steel for new equipment, the railroads will receive from the fourth-quarter allotments 400,000 tons of replacement rail, 240,000 tons of track accessories, and 300,000 tons of other maintenance materials.

Another recent development in the equipment field was information revealed at WPB that the 1944 production program contemplates the building of 4,000 steam locomotives, 2,500 more than this year's program calls for. The increase will not mean more locomotives for domestic service, for the additional production will all be assigned to the Army and the Lend-Lease Administration for service abroad. In order to permit them to meet the stepped-up schedules, the locomotive builders will be taken out of tank production, thus marking the first big reconversion step in the railway equipment field.

ODT Appointments

THE Office of Defense Transportation has announced the promotion of James B. Friend from deputy director to deputy associate director of the Mechanical Section of the ODT's Division of Railway Transport. In his new post he will continue in charge of the Chicago office of the section. Before he was transferred to Chicago, in March of this year, to open this office, Mr. Friend had been deputy director of the ODT Mechanical Operations Section, stationed in Washington, D. C. Before he joined the ODT staff in October, 1942, he was master mechanic of the Texas & Pacific.

Albert V. James, recently mechanical assistant in the Chicago office of the Mechanical Operations Section, has been transferred to San Francisco, Calif., where he will establish a new office of the division's Mechanical Section. His position in Chicago will be filled by R. P. O'Neil, who has been since June of this year mechanical assistant in the Washington office. Before joining the ODT staff, Mr. O'Neil was master mechanic of the Kentucky & Indiana Terminal at Louisville, Ky.

Orders and Inquiries for New Equipment Placed Since the Closing of the August Issue

LOCOMOTIVE ORDERS

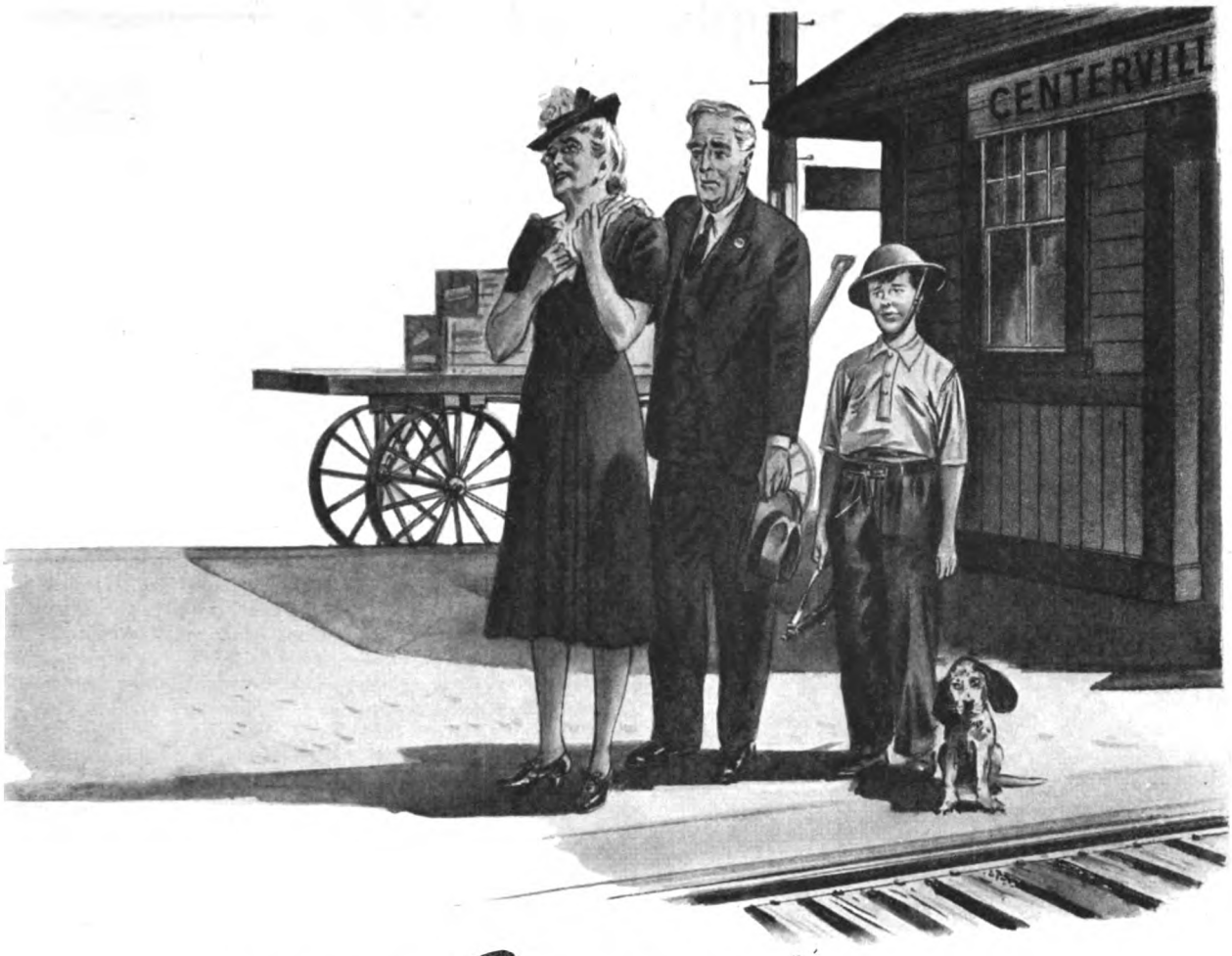
Road	No. of Locos.	Type of Loco.	Builder
Chicago Milwaukee, St. Paul & Pacific	10[1]	4-8-4	American Loco. Co.
Erie	6[2]	5400-hp. Diesel-electric	Electro-Motive Corp.
Louisville & Nashville	6[3]	2-8-4	Baldwin Loco. Wks.
Northern Pacific	8[3]	4-6-6-4	American Loco. Co.
Spokane, Portland & Seattle	2[3]	4-6-6-4	American Loco. Co.
Wheeling & Lake Erie	6	0-6-0	American Loco. Co.

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Atchison, Topeka & Santa Fe	600[4]	Box	Gen. Amer. Trans. Cp.
	200[4]	Gondola	Gen. Amer. Trans. Cp.
	200[4]	Hopper	Gen. Amer. Trans. Cp.
Canadian Pacific	750[5]	Box	National Steel Car Co. Can. Car & Fdry. Co. Eastern Car Co.
Chicago & Illinois Midland	62[6]	40-ton gondola	Mather Stock Car Co.
Chicago, Milwaukee, St. Paul & Pacific	300[6]	Box	Co. shops
Clinchfield	100[7]	Hopper	Amer. Car & Fdry Co.
Detroit, Toledo & Ironton	30[8]	70-ton hopper	Greenville Steel Car
Elgin, Joliet & Eastern	200[9]	Hopper	Ralston Steel Car Co.
Great Lakes Steel Corp.	30	70-ton gondola	Pressed Steel Car Co.
Lehigh Valley	900[10]	Hopper	Bethlehem Steel Co.
	250[10]	Gondola	Bethlehem Steel Co.
Timken Roller Bearing Co.	25	70-ton gondola	Amer. Car & Fdry Co.

[1] Order unconfirmed.
[2] For 1944 delivery. The locomotives, which will cost $465,000 each, are reported to be scheduled for freight service between Marion, Ohio, and Meadville, Pa.
[3] WPB approval reported to have been received.
[4] WPB approval received. To be of composite wood and steel construction.
[5] The road expects to save approximately 850 tons of steel by the use of plywood in the construction of these cars. In 500 of the new cars, ⅝-in. plywood has been specified for the outside steel sheathing formerly used, the inner wood lining being retained. The remaining 250 cars will use 1½-in. wood put inside the steel side posts of the cars, replacing both the steel sheathing and inner wood lining. The plywood is hot-pressed, resin-bonded, and is bolted to the steel side posts of the car. The cars will be welded instead of riveted, with lighter castings throughout.
[6] WPB authorization received.
[7] In addition to 400 hopper cars previously ordered. The War Production Board has authorized the building of 200 of the 500 cars during the fourth quarter of this year and the railroad is endeavoring to secure the board's approval to build the entire number by that time.
[8] In addition to 70 previously ordered. The cars are to be of composite wood and steel construction. War Production Board authorization for the building of the 100 cars has not been received
[9] Subject to WPB approval.
[10] For 1944 delivery. To be of composite wood and steel construction.

(*Turn to next left-hand page*)



HE CAN COME BACK *Sooner*

Another boy off to war.

To face the risks of a *short* war or a *long* war?

Every day he's away adds to the risks he must face.

Sure, he's ready to face them all.

But is it fair to make him face so many?

We can buy his return-trip ticket *right now*

by investing in the 3rd War Bond Drive.

Back the attack 3RD WAR LOAN ***with War Bonds***

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

3398

Supply Trade Notes

ALLOYS DEVELOPMENT CORPORATION.—*Otis W. Hovey* has been appointed development engineer on the staff of the Alloys Development Corporation, New York. The company was a pioneer in the development and promotion of weight-saving steels of the low-alloy high-strength type, and for a number of years has furthered their use, principally, in the modern design of mobile structures used in land and water transportation. Mr. Hovey is a graduate of Dartmouth College and of the Thayer School of Engineering. He served



Otis W. Hovey

with the Army Engineers in World War I and has since been engaged as designing engineer on many types of steel structures. During recent years Mr. Hovey has devoted himself to the lightweight trend in railroad equipment, having been employed for some time by the Edward G. Budd Manufacturing Company on designs employing stainless steel. He was later associated for several years in the railroad research bureau of the subsidiary companies of the United States Steel Corporation in developing uses for high-strength low-alloy steels in railroad freight-car construction. Mr. Hovey's headquarters will be at the company's offices, Park building, Pittsburgh, Pa.

◆

AMERICAN BRAKE SHOE COMPANY.—*John V. Houston,* assistant chief engineer at the Chicago plant of the Ramapo Ajax Division of the American Brake Shoe Company, has been appointed general superintendent of Ramapo Ajax, with headquarters at New York. He succeeds *J. G. Tattersell,* who has been appointed assistant to the vice-president with headquarters at Niagara Falls, N. Y. Following his graduation as a civil engineer from the University of Illinois in 1909, Mr. Houston was employed in the engineering department of the Chicago, Milwaukee & St. Paul. In 1910 he joined the Ajax Forge Company which became a part of Ramapo Ajax in 1922.

LUKENWELD, INC.—*C. L. Huston, Jr.,* assistant to the president and member of the board of directors of the Lukens Steel Company, has been named president of the company's subsidiary, Lukenweld, Inc., to succeed *Everett Chapman* who has resigned to establish his own business as a consulting engineer. Mr. Huston was graduated from Princeton University in 1928. He joined the American Rolling Mill Company, in Middletown, Ohio, in 1929, serving for five years in the metallurgical department and for five years on the company's personnel relations staff in public relations, employment and training work. In 1939 he resigned as assistant staff supervisor of employment in charge of introductory training for the American Rolling Mill, to join the Lukens Steel Company as director of personnel relations.

◆

BALDWIN LOCOMOTIVE WORKS.—*Kenneth F. Cramer* has been appointed district manager of the New York office of The Baldwin Locomotive Works, succeeding *Joseph F. Hoerner,* who has been assigned to special duties in Washington, D. C. Mr. Cramer will direct New York district sales



K. F. Cramer

for all divisions of the company. *James J. Nelson* has been appointed general manager of the Cramp Brass & Iron Foundries division of the Baldwin Locomotive Works.

Kenneth F. Cramer became associated with the Baldwin company in October, 1940, as Kansas City district manager for the Diesel division. In September, 1942, he was transferred to the Chicago office, specializing in Diesel locomotive work. Since the war, Mr. Cramer has been dividing his time between the Baldwin offices in Kansas City, Chicago, and Washington in connection with negotiations with various branches of the Federal government and the armed forces. Mr. Cramer was born in Fulton, N. Y., and received his early education in the schools of Syracuse, N. Y. He is a graduate of Syracuse University, from which he received a degree in mechanical engineering in 1928. After graduation he was employed by the Worthington Pump & Machinery Corporation at their Harrison, N. J., and Buffalo, N. Y., plants. At Buffalo he was test and experimental Diesel engineer. In July, 1929, he joined the McIntosh and Seymour Corporation (later the Diesel Engine division, American Locomotive Company) at Auburn, N. Y. After some months in the experimental and testing departments, he was transferred to the New York sales office and, later, to the main sales office at Auburn. Following that assignment he was in charge of McIntosh and Seymour Diesel sales in Chicago for two years. He then returned to New York. He was in private business for two years before joining the Baldwin organization.

James J. Nelson joined the Cramp Brass & Iron Foundries in 1932 as vice-president and sales manager, and continued as sales manager of the Cramp division when the company became affiliated with the Baldwin group. He previously was associated with the American Manganese Bronze Company as New York representative, and was appointed sales manager of that company in Philadelphia, Pa., in 1926. Mr. Nelson served in the United States Navy from 1912 to 1919, resigning to become an assistant on the Joint Board of Review which arranged the return to private owners of vessels commandeered by the government during the first world war.

◆

TIMKEN ROLLER BEARING COMPANY.—*S. R. Kallenbaugh,* metallurgical service representative in Cleveland, Ohio, and Detroit, Mich., for the Timken Roller Bearing Company, has been appointed west coast district manager of the company's steel and tube division, with offices in Los Angeles, Calif.

◆

AMERICAN STEEL & WIRE COMPANY.—*W. H. Cordes,* advertising manager of the American Steel & Wire Company, a subsidiary of the United States Steel Corporation, has been appointed to head the newly created sales research and development division of the company. Mr. Cordes has been associated with the American Steel & Wire Company for thirty years and has been manager of sales promotion and advertising since 1935.

Army-Navy E Awards

American Welding Company, subsidiary of the American Car & Foundry Company, Carbondale, Pa.

Fansteel Metallurgical Corporation, North Chicago, Ill. August 19.

Heywood-Wakefield Company, Gardner, Mass. July 21.

Maritime M Award

Air Reduction Company. (Subsidiary companies, and their 159 plants, factories, and laboratories). July 17.

(*Turn to next left-hand page*)

LIMA LOCOMOTIVES HELP THE R. F. and P. KEEP VITAL WAR FREIGHT

Moving



In its role as the principal linking line between the railroads of the north and south along the Atlantic Coast, the Richmond, Fredericksburg and Potomac R. R. has been doing an outstanding job in keeping America's wartime freight rolling.

Operating figures for the past three years give ample evidence of the fine wartime performance of this road:

	1940	1941	1942
Freight train miles	739,210	992,857	1,546,342
Tons of revenue freight handled .	4,563,981	6,599,612	11,758,693

By a progressive motive power program the R. F. and P. has succeeded in keeping abreast of these unusual demands. This program included the purchase of 10 powerful Lima-built high-speed freight locomotives of the 2-8-4 type shown above.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

GENERAL MOTORS CORPORATION.—*Cyrus R. Osborn*, of Detroit, Mich., assistant to vice-president of the General Motors Corporation, has been elected vice-president in direct charge of the Electro-Motive Division at LaGrange, Ill. Until two years ago Electro-Motive was a separate corporation of which *H. L. Hamilton* was



H. L. Hamilton

president and *F. H. Prescott* was vice-president and general manager. It was then consolidated with the General Motors Corporation, and Mr. Hamilton became a vice-president of the Corporation in charge of the Electro-Motive Division, Mr. Prescott continuing to be general manager. Under the new organization Mr. Hamilton continues as a vice-president of General Motors, and will be chairman of the executive committee of the Electro-Motive Division; Mr. Osborn, as vice-president, will be, as stated, in direct charge of the Electro-Motive Division, with headquarters at LaGrange, and Mr. Prescott will report to Mr. Osborn. *A. W. Phelps* has been transferred from the Electro-Motive Division to be assistant to E. F. Johnson, vice-president of General Motors, with headquarters in Detroit.

H. L. Hamilton, who was born at Little Shasta, Calif., on June 14, 1890, began his railroad career as a call boy on the Southern Pacific and worked in locomotive service on a number of roads. He became road foreman of engines for the Florida East Coast, which position he left in 1914 to join the White Automobile Company at Denver, Colo. He worked for this company in various capacities both in the engineering and sales departments, becoming western wholesale manager in 1920. During this period, he not only experimented with White automotive equipment adapted for operation on rails, but became generally familiar with the advantages and limitations of other automotive-type rail equipment including the early G. E. gas-electric and the McKeen motor cars. He served as civilian member of the Engineering Committee, Motor Transport Corp., U. S. A., for about 14 months during World War I.

Mr. Hamilton recognized the need for rail motor equipment designed especially for branch line and secondary passenger service, and in 1922 founded the Electro-Motive Company at Cleveland, Ohio, which in the next eight years, or until 1930, produced about 600 gas-electric rail cars driven by Winton gasoline engines ranging from 175 hp. to 900 hp. As early as 1928 the limitations of gasoline-engine drive from horsepower and economy standpoints became apparent, and Mr. Hamilton instituted research, in conjunction with the Winton Engine Company, to see if a Diesel engine could be developed to meet the increased power requirements for railway service. General Motors purchased the Electro-Motive Corporation in 1930, and also took over the Winton Engine Company, continuing the Diesel-engine research and installing the first successful two-cycle 600-hp. Diesel-electric power plant in the Burlington's Pioneer Zephyr in 1934. In 1935, under Mr. Hamilton's direction, the Electro-Motive plant at LaGrange, Ill., was built, being expanded in 1938 to afford completely integrated manufacturing facilities for Diesel locomotives, including the engines, electric transmssion, locomotve bodies, trucks and auxiliary equipment.

Mr. Hamilton has been particularly active in co-ordinating Electro-Motive activities with the war effort. Ths company was selected by the Navy to manufacture the Pancake Diesel engine, developed in 1936 as a result of collaboration between the Navy and General Motors research organizations. A separate new plant, built by the Electro-Motive Division at LaGrange in the fall of 1940, was in full production on this engine 12 months later. In January, 1942, the greatly enlarged Navy shipbuilding program necessitated another increase of 125 per cent in Electro-Motive facilities for manufacturing the 12-cylinder railroad Diesel engine which had been adapted with some slight modifications to marine service. The required plant enlargement was completed and placed in operation by January, 1943.

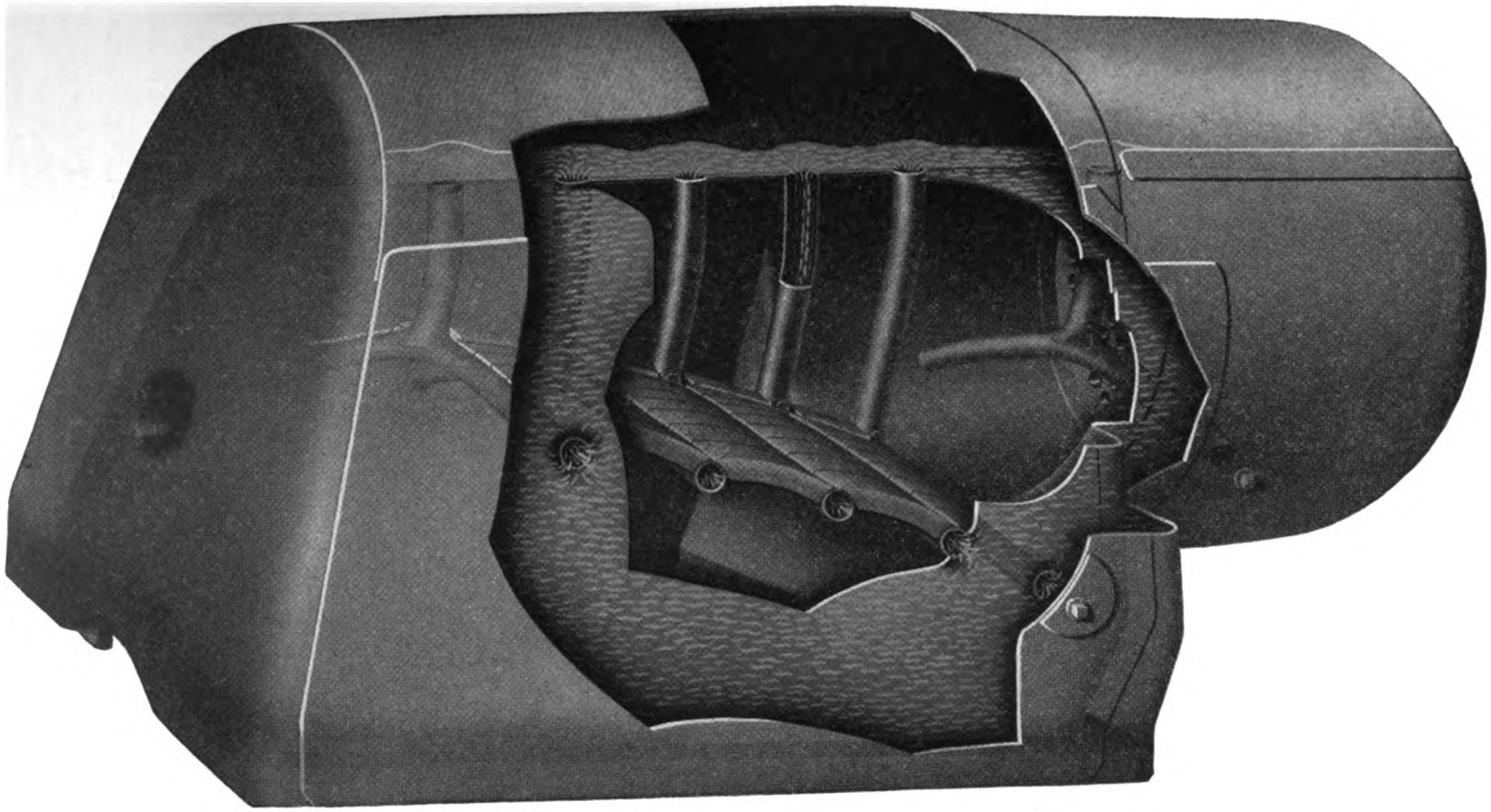
After General Motors acquired the Electro-Motive Corporation in 1930, in which Mr. Hamilton was the principal owner, he moved his family from Cleveland to Los Altos, Calif., with the intention of taking up other activities. However, in 1934 General Motors called him back to build the plant at LaGrange and establish the Diesel locomotve activity. Although a resident of California, Mr. Hamilton will retain a direct and personal interent in the Diesel locomotive activities of General Motors Corporation, particularly in the capacity of chairman of the executive committee of the Electro-Motive Division, and consultant on major problems arising in the Diesel locomotive activity.



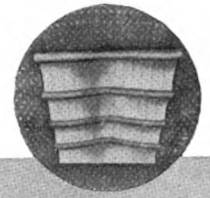
C. R. Osborn

Cyrus R. Osborn was born in Dayton, Ohio, on August 27, 1897. He received his early education in Dayton public schools, and was graduated from the University of Cincinnati with a degree in Mechanical

(*Continued on next left-hand page*)



Security Circulators not only give increased circulation throughout the water legs but maintain a positive flow of water over the CENTER LINE of the crown sheet.



AMERICAN ARCH COMPANY
INCORPORATED · 60 East 42nd Street, New York 17, N. Y.
SECURITY CIRCULATOR DIVISION

Engineering in 1921. Mr. Osborn's first employment with General Motors was as an apprentice in the Dayton Engineering Laboratories Company in July, 1921. He became a field service engineer a few months later. In December, 1923, he became technical manager of Overseas Motors Service Corporation, and in September, 1925, was named general manager of that organization. From 1929 until 1932 he served as general manufacturing manager of GM Export Division. In May of the same year he went to Stockholm, Sweden, as managing director of General Motors Nordiska. He remained in Stockholm until February, 1934, after which he served on special assignments in Mexico and England. At the beginning of 1935, Mr. Osborn was placed in charge of engineering for the Overseas Division, and a year later was appointed assistant to the general manager. Early in 1936 he was sent on special assignment to Adam Opel A. G. in Russelsheim, Germany, and in July of the same year became special assistant to the general manager there. He was appointed general manager of the Opel operation on July 1, 1937. He returned to this country in June, 1940, and became active in defense material relationships at the central office in Detroit. In 1941 he was appointed assistant to R. K. Evans, vice-president of General Motors in charge of the General Engine Group, which includes the Electro-Motive Division, and on August 1, 1943, was elected a vice-president of the corporation. Mr. Osborn is a member of the Society of Automotive Engineers.

◆

NATIONAL BEARING METALS CORPORATION.—*Thomas W. Pettus,* sales manager of the National Bearing Metals Corporation, St. Louis, Mo., has been elected vice-



Thomas W. Pettus

president in charge of sales. Mr. Pettus was born in St. Louis on October 3, 1905, and was graduated from Princeton University in 1927. He entered the employ of the National Bearing Metals Corporation on January 1 of the following year and from 1931 to 1941 served as a salesman. In the latter year he was placed in charge of priorities and in 1942 was appointed sales manager.

CARBOLOY COMPANY.—*K. R. Beardslee,* for the past seven years general sales manager of the Carboloy Company, Detroit, Mich., has been named vice-president in charge of sales. Mr. Beardslee, who has



K. R. Beardslee

been associated with the Carboloy Company for the past thirteen years, first in the Newark branch office and later as district manager in the Pittsburgh office, will thus be in direct charge of the sale of all Carboloy products, including dies, tools, tool grinders, wheel dressers, electronic brazing equipment, etc. Mr. Beardslee is a member of both the Wire Association and the American Society of Tool Engineers.

◆

STANDARD STOKER COMPANY.—*T. L. Capps,* service sales engineer for the Standard Stoker Company, has been appointed resident manager and service engineer in Canada, with headquarters in the company's Montreal, Que., office, to succeed the late *Carl T. Mead.*

◆

H. K. PORTER COMPANY.—The H. K. Porter Company, of Pittsburgh, Pa., has purchased the Quimby Pump Company, with plants at Newark, N J., and New Brunswick. The Quimby plants will be operated as a division of the Porter company.

◆

SKF INDUSTRIES, INC.—*Fred S. Ball* has been appointed railway engineer of SKF Industries, Inc., Philadelphia, Pa., to succeed Lieutenant-Commander *B. W. Taylor,* U. S. N. R., who has been assigned to the production branch of the Bureau of Aeronautics, at Washington, D. C.

◆

B. F. GOODRICH COMPANY.—*R. G. Cox,* who has been with the industrial products organization of the B. F. Goodrich Company for the last 18 years, has been placed in charge of molded goods sales, to succeed *E. R. Miller,* who recently retired.

◆

EVERLASTING VALVE COMPANY.—*Cecil Davey* has been elected vice-president and general manager of the Everlasting Valve Company, Jersey City, N. J. Mr. Davey began his career with the company in 1911. He was appointed plant superintendent in 1916, and subsequently was placed in charge of purchases.

◆

IRON & STEEL PRODUCTS, INC.—*Adolph G. Schroeder,* sales representative of Iron & Steel Products, Inc., Chicago, has been appointed manager of the machinery department to succeed *A. E. Waleski,* resigned.

◆

PHILCO CORPORATION.—*Palmer M. Craig,* for the past two years chief engineer in charge of radar and radio communications equipment development, has been appointed chief engineer of the radio division of the Philco Corporation.

◆

GENERAL ELECTRIC COMPANY.—*Ralph J. Cordiner* has been appointed assistant to the president of the General Electric Company. Mr. Cordiner, who resigned in June as vice-chairman of the War Production Board, was formerly president of Schick, Inc., of Stamford, Conn., and, prior thereto, manager of the appliance and merchandise department of the General Electric Company.

◆

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY.—*Alfred M. Wilson* has been elected a vice-president of the Minneapolis-Honeywell Regulator Company, Minneap-



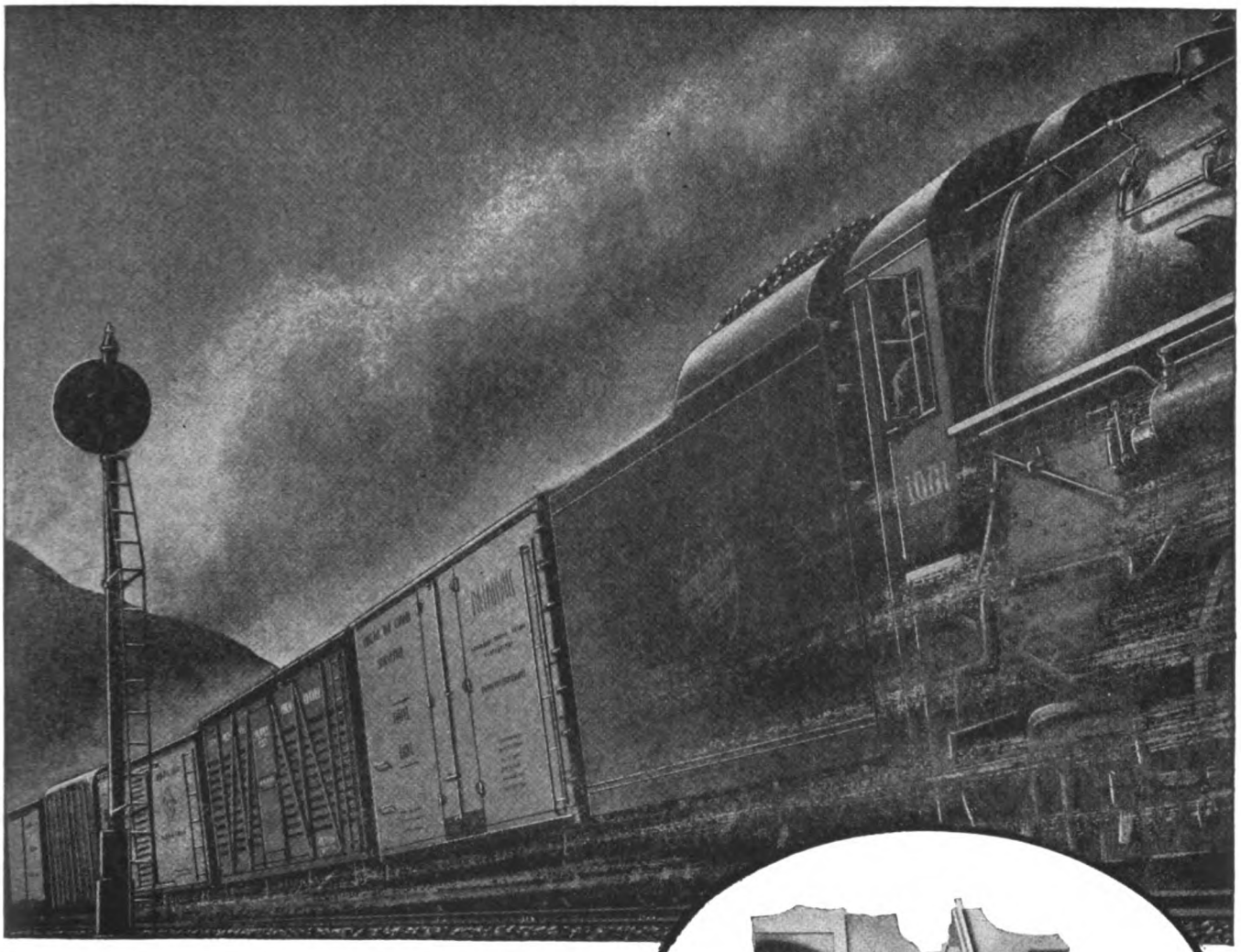
A. M. Wilson

olis, Minn. Mr. Wilson has served as assistant to the president of Minneapolis-Honeywell since joining the organization in August 1941. He was formerly associated with J. & W. Seligman & Co., investment bankers in New York City.

◆

CATERPILLAR TRACTOR COMPANY.—*Henry H. Howard,* formerly manager, engine sales department, of the Caterpillar Tractor Company, Peoria, Ill., who has been on temporary emergency service with the United States Ordnance Department, has returned to the Caterpillar Tractor Company as general sales manager. *J. Q. McDonald,* acting general sales manager returns to his duties as export manager. *H. W. Smith,* assistant manager, engine sales department, has been appointed manager of that department.

(*Turn to next left-hand page*)



Increased safety at *high speeds*

A jouncing, jolting, swaying ride on a fast-moving locomotive deck is an emphatic reminder of the stresses the engine-tender connection must withstand. The higher the speed and tonnage the greater the need for safety and smooth riding.

On thousands of locomotives throughout the country, the Franklin Radial Buffer Type E-2 has provided an ideal, non-binding connection between engine and tender. Its smooth, powerful action deadens vibration and gives increased resistance to compression resulting in improved riding quality and safety of operation.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.
NEW YORK • CHICAGO
In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

WHITING CORPORATION.—*John Easton* has been appointed director of the development and standardization activities of the Whiting Corporation to succeed *A. J. Brown*, who has been transferred to California as manager of the Pacific coast branch.

◆

GLOBE STEEL TUBES COMPANY.—*C. A. Schroeder*, manager of the Wisconsin-Minnesota district of the Globe Steel Tubes Company has been appointed manager at Cleveland, Ohio. *E. Gammeter*, formerly with the Carnegie-Illinois Steel Company at Chicago has been appointed chief metallurgist for the company at Milwaukee, Wis.

◆

WORTHINGTON PUMP & MACHINERY CORP.—The Worthington Pump & Machinery Corporation, Harrison, N. J., has acquired the Ransome Machinery Company, Dunellen, N. J., as a wholly-owned subsidiary. The Ransome company, designers and builders of machinery since 1850, manufacture concrete mixers, road paving equipment, welding positioners and turning rolls.

Obituary

ALLAN H. MCMAHAN, district manager of the Portsmouth, Va., plant of the National Bearing Metals Corporation, St. Louis, Mo., died on July 25. Mr. McMahan was born on June 25, 1902, and became associated with the National Bearing Metals Corporation on a temporary basis in 1920 and after being graduated from Washington University in 1923 was employed permanently.

◆

WALTER H. SMITH, transportation engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., died at the West Penn Hospital, Pittsburgh, Pa., on August 3, 1943. Mr. Smith was born in Ridgeville, N. C., on November 21, 1888, and received a degree in Electrical Engineering from North Carolina State College in 1914. He entered the service of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., as an engineering apprentice in July, 1914, graduating into the Railway Engineering Department, where he remained until the end of 1927. On January 1, 1928, Mr. Smith went with the Reading Railroad, Philadelphia, as assistant electrical engineer, remaining with that railroad through the electrification of the Philadelphia suburban service. On June 1, 1937, he returned to Westinghouse. His recent contributions to the electrical industry have been through the development of regulating devices for railroad use and for military mechanisms.

◆

J. FRED COMEE, sales representative of the Standard Railway Equipment Manufacturing Company, Hammond, Ind., died on July 23.

◆

EDWARD F. KENNEY, metallurgical engineer on the staff of the vice-president of operations of the Bethlehem Steel Company, died July 8, at Media, Pa. Mr. Kenney was 74 years of age. He began his career with the Pennsylvania as assistant engineer of construction, later becoming engineer of tests of the maintenance of way department, with headquarters at Philadelphia, Pa.

Personal Mention

General

PAUL N. FOX has been appointed mechanical engineer of the Detroit, Toledo & Ironton, with headquarters at Dearborn, Mich.

K. L. SELBY has been appointed to the newly created position of mechanical engineer of the Alton, with headquarters at Chicago.

G. E. MCKINNEY has been appointed electrical engineer of the Erie, with headquarters at Cleveland, O., succeeding W. S. James, deceased.

ERIC WYNNE, mechanical inspector of the Canadian National, has been appointed mechanical engineer, shop methods, with headquarters as before at Montreal, Que.

H. S. WALL, mechanical superintendent, Coast lines of the Atchison, Topeka & Santa Fe with headquarters at Los Angeles, Calif., has retired.

J. N. GLOVER has been appointed supervisor of oil-gas-electric mobile power of the Union Pacific, with headquarters at Omaha, Neb.

WILLIAM D. HARTLEY, mechanical superintendent of the Atchison, Topeka & Santa Fe at Ft. Madison, Ia., has been transferred to the position of mechanical superintendent at Topeka, Kan.

G. A. HILL, superintendent of motive power and cars of the Wheeling & Lake Erie, has been appointed general superintendent in charge of train, station and yard operations, and maintenance of way and structures, with headquarters as before at Brewster, Ohio.

G. E. DURHAM, assistant to the superintendent of motive power and cars of the Wheeling & Lake Erie, has been appointed to superintendent of motive power and cars, with headquarters as before at Brewster, Ohio.

GEORGE STANLEY WEBB, whose appointment as superintendent of motive power of the Southern division of the Pennsylvania, with headquarters at Wilmington, Del., was announced in the August issue of the *Railway Mechanical Engineer*, was



George S. Webb

born on April 20, 1897, at New Athens, Ohio, and was a graduate of the University of Illinois in 1920. Mr. Webb, who has had a varied experience in the operation and maintenance of steam and electric equipment, entered railroad service in June, 1920, as an employee of the Chicago Elevated railroad, and in October of that year, became a draftsman in the office of the electrical engineer of the Pennsylvania at Altoona, Pa. He subsequently served as special electrical apprentice, motive-power inspector, and assistant master mechanic of the West Jersey & Seashore (now Pennsylvania-Reading Seashore Lines); assistant master mechanic of the Long Island, and assistant master mechanic of the Philadelphia terminal division of the Pennsylvania. In 1932 he was appointed electrical foreman at Wilmington, and thereafter served successively as assistant foreman in the office of the electric engineer; general electrician of the Eastern region, in the office of the general superintendent of motive power; assistant master mechanic at Columbus, Ohio, and master mechanic of the Chicago terminal and Logansport division. Mr. Webb served in the latter position until his appointment as superintendent motive power at Wilmington.

W. P. HARTMAN, mechanical superintendent, Eastern lines, of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been transferred to the position of mechanical superintendent at Los Angeles, Calif.

FRANK WILLIAMS, mechanical engineer, in charge of shop methods of the Canadian National at Montreal, Que., has been appointed chief mechanical engineer, with headquarters at Montreal. Mr. Williams was born at Otterton, Devon, England. He received his special apprenticeship training in the shops and enginehouse drawing offices of the former London &

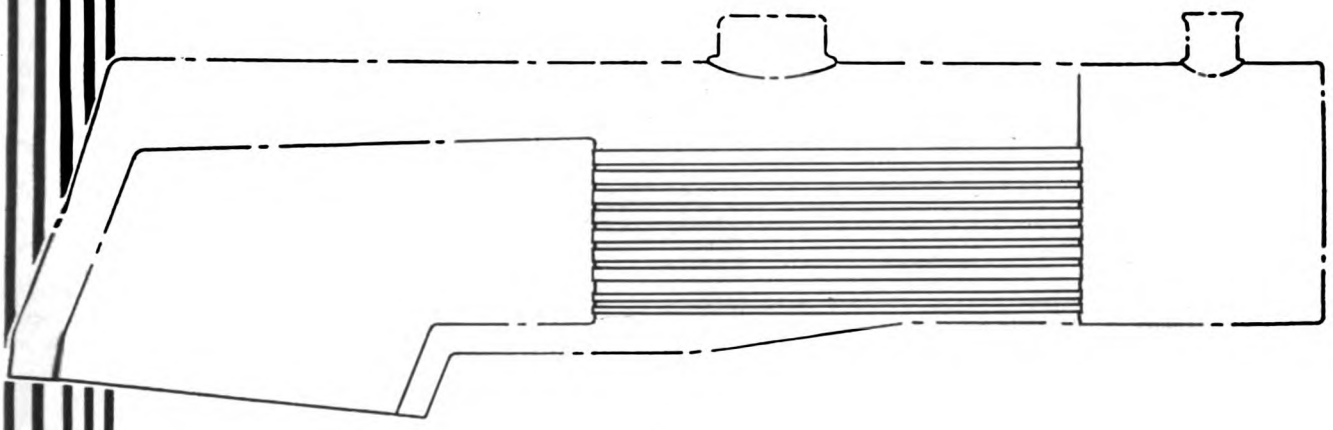
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LOCOMOTIVE BOILERS

"The sustained hauling capacity of a steam locomotive depends primarily on the ability of the boiler to provide the necessary steam . . ."

—THE RAILWAY GAZETTE

April 9, 1943



Small flue boilers with Elesco superheaters provide maximum evaporating and superheating surfaces.

Be sure they are included in the specifications for your new locomotives.

ELESCO

A-1601

SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

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South Western, which training was later amplified by technical instruction. He came to Canada in 1911 and was employed by the Montreal Locomotive Works. In 1914 he entered the service of the Canadian Government Railways as a draftsman in the mechanical department. Two years later he was loaned to a munitions plant, returning to railway service at Moncton in 1918. He later advanced through the positions of mechanical designer and mechanical engineer and in January, 1929, he was transferred to Montreal as mechanical engineer in charge of shop methods. In April, 1933, Mr. Williams took charge of shop methods for the entire system, in which position he continued until his appointment as chief mechanical engineer.



C.N.R. Photo

Frank Williams

GEORGE B. HALSTEAD, who has been appointed assistant to superintendent motive power of the Virginian with headquarters at Princeton, Va., as announced in the August issue, was born on June 28, 1879, at Portsmouth, Va. He attended public school at Portsmouth, the Southern Shorthand Business University at Norfolk, Va., 1896-97; and Randolph Macon Academy, Bedford City, Va., 1899-1901. He became a mechanical draftsman in the employ of the Seaboard Air Line at Portsmouth on January 22, 1906, and was promoted to the position of chief mechanical draftsman on June 20, 1906. He became first mechanical draftsman of the Tide Water & Deep Water Railway and the Virginian at Norfolk on September 16, 1907. On May 1, 1910, he became chief mechanical draftsman at Princeton; on November 1, 1917, shop superintendent. on December 1, 1918, master car builder; on April 16, 1919, freight car foreman. He resigned from the latter position on August 1, 1919, and from October 16, 1919, until January 26, 1920, was an A and B mechanical accountant at Norfolk. He was car engineer of the American Steel Company of Cuba at Horono, Cuba, from January 26, 1920, until May 1, 1921, and assistant general manager from May 1, 1921, to July 10, 1922. On April 23, 1923, he became assistant foreman in charge of erecting track, car department, at the Newport News Shipbuilding & Drydock Company, Newport News, Va. He was appointed mechanical inspector of the Virginian on March 1, 1924; general foreman car department, April 1, 1930, and assistant to superintendent motive power at Princeton on July 1, 1943.



G. B. Halstead

A. C. MELANSON, superintendent of motive power and car equipment of the Quebec district of the Canadian National, has been promoted to a similar position on the Southern Ontario district, with headquarters at Toronto, Ont. Mr. Melanson entered railway service at the age of 18 as a machinist apprentice on the Canadian Government Railways. He later became a draftsman and in January, 1922, was appointed material inspector, later serving as superintendent of the St. Malo, Que., motive power and car shops of the C. N. R. In February, 1939, Mr. Melanson was appointed superintendent of motive power and car equipment for the Quebec district.



A. C. Melanson

F. BITTNER has been appointed superintendent of motive power and car equipment of the Quebec district, Central region, of the Canadian National, with headquarters Quebec, Que. Mr. Bittner is a native of Pittsburgh, Pa. He entered railway service in 1904 as machinist apprentice. In October, 1908, he became a machinist in the employ of the Quebec, Montreal & Southern, serving in that capacity at several points on the road. From June, 1917, to October, 1929, he served successively as erecting shop foreman, fitter, locomotive fireman and machine shop foreman. When the Quebec, Montreal & Southern was taken into the Canadian National system in 1929, Mr. Bittner was appointed assistant foreman. The following year he became night locomotive foreman at Janquiere, Que., and in April, 1937, locomotive and car foreman at Taschereau, Que. Four years later he was promoted to the position of locomotive foreman at Limoilou, Que., which position he held at the time of his recent appointment as superintendent of motive power and car equipment of the Quebec district.



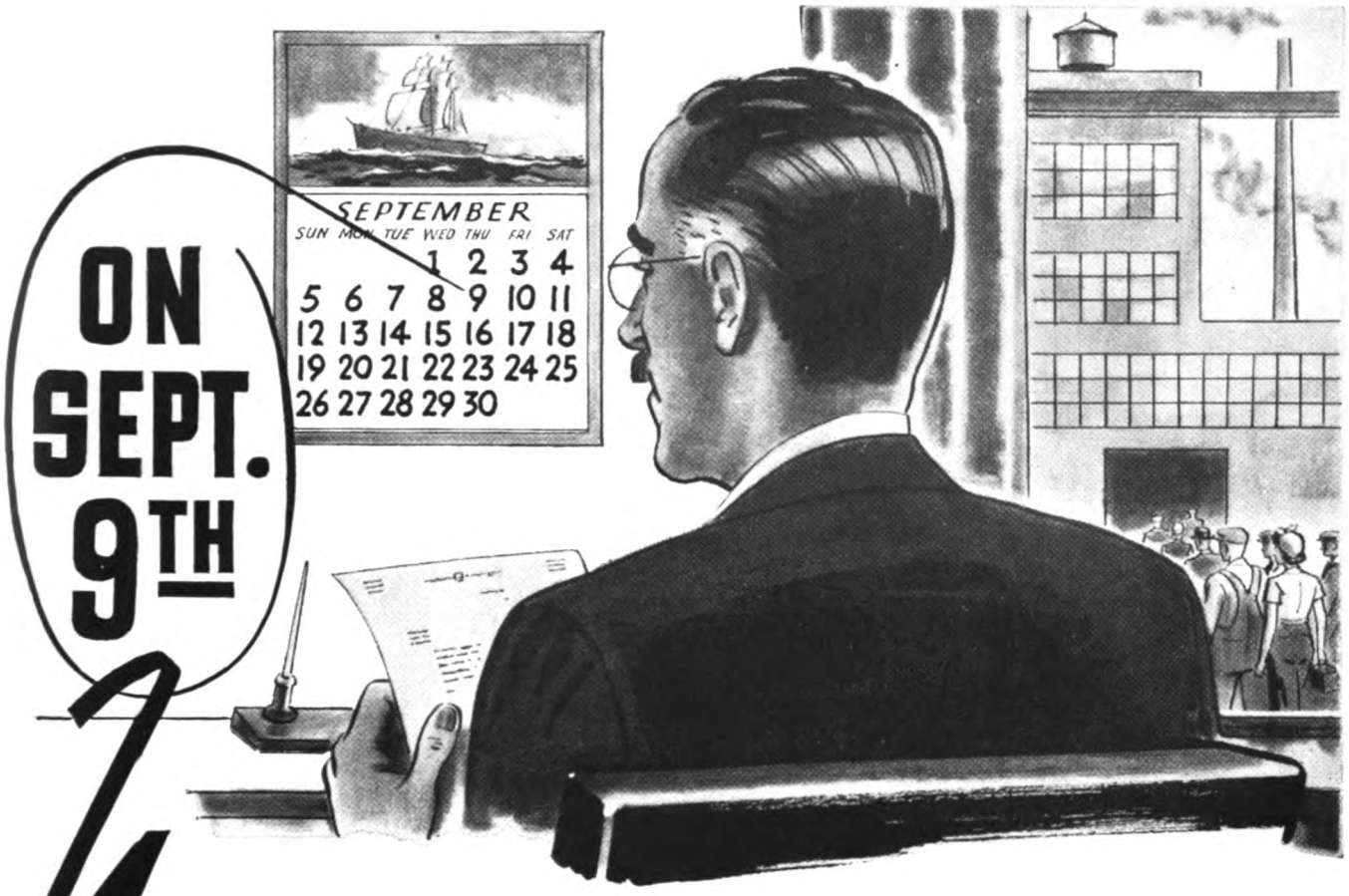
Frank Bittner

W. F. CONNAL, chief mechanical engineer of the Canadian National with headquarters at Montreal, Que., has retired under the company's pension regulations. Mr. Connal was born at Peterboro, Ont. He is a graduate of McGill University where he received a B.S. degree in 1897. After serving in various shop and engineering positions in Cleveland, Chicago, Philadelphia and New York, Mr. Connal engaged in construction work on the National Transcontinental. In 1919 he was

(Continued on second left-hand page)



W. F. Connal



Your Bond Selling Responsibilities Double!

Starting September 9th, your Government will conduct the greatest drive for dollars from individuals in the history of the world—the 3rd War Loan.

This money, to finance the invasion phase of the war, must come in large part from individuals on payrolls.

Right here's where YOUR bond selling responsibilities DOUBLE!

For this extra money must be raised *in addition* to keeping the already established Pay Roll Allotment Plan steadily climbing. At the same time, every individual on Pay Roll Allotment must be urged to dig deep into his pocket to buy *extra* bonds, in order to play his full part in the 3rd War Loan.

Your now *doubled duties* call for these two steps:

1. If you are in charge of your Pay Roll Plan, check up on it at once—or see that whoever is in charge, does so. See that it is hitting on all cylinders—*and keep it climbing!* Sharply increased Pay Roll percentages are the best warranty of sufficient post war purchasing power to keep the nation's plants (*and yours*) busy.

2. In the 3rd War Loan, every individual on the Pay Roll Plan will be asked to put an *extra two weeks salary* into War Bonds—over and above his regular allotment. Appoint yourself as one of the salesmen—and see that this sales force has every opportunity to do a real selling job. The sale of these *extra* bonds cuts the inflationary gap and builds added post-war purchasing power.

Financing this war is a tremendous task—but 130,000,000 Americans are going to see it through 100%! This is their own best *individual* opportunity to share in winning the war. The more frequently and more intelligently this sales story is told, the better the average citizen can be made to understand the wisdom of turning every available loose dollar into the finest and safest investment in the world—United States War Bonds.

★ ★ ★

BACK THE ATTACK With War Bonds!

This Space Is a Contribution to America's All-Out War Program by Railway Mechanical Engineer

45%

MORE GROSS-TON-MILES PER DAY WITH GM DIESELS ON THE Rio Grande





Rio Grande territory ranges from high snow country to desert areas, thus covering a wide temperature range.

From Denver, exactly one mile above sea level, the Diesels climb 50 miles of ascending 2.0 percent ruling gradient to the East Portal of the Moffat Tunnel. Apex of tunnel is 9,239 feet, the highest point on the route of the Diesels. After piercing the 6.2 miles tunnel bore, they continue 323 miles on descending gradients of varying degrees to Green River, Utah, the lowest point on the system (elevation 4,075 feet). From Green River, the Diesels ascend 96.3 miles of 1.0 to 2.4 percent grades to Soldier Summit, Utah (elevation 7,440 feet), after which they descend on a 2.0 percent grade to Salt Lake City (elevation 4,235 feet).

★ KEEP AMERICA STRONG — BUY MORE WAR BONDS ★



53.6% MORE LOCOMOTIVE MILES PER MONTH HANDLING SAME TONNAGE 13.7% FASTER . . .

IN fifteen months of operation, the first three General Motors 5400 Hp. Diesel Freight Locomotives, pulling symbol trains over the mountainous Moffat Tunnel Route between Denver and Salt Lake City (570 miles), have established the following performance highlights . . .

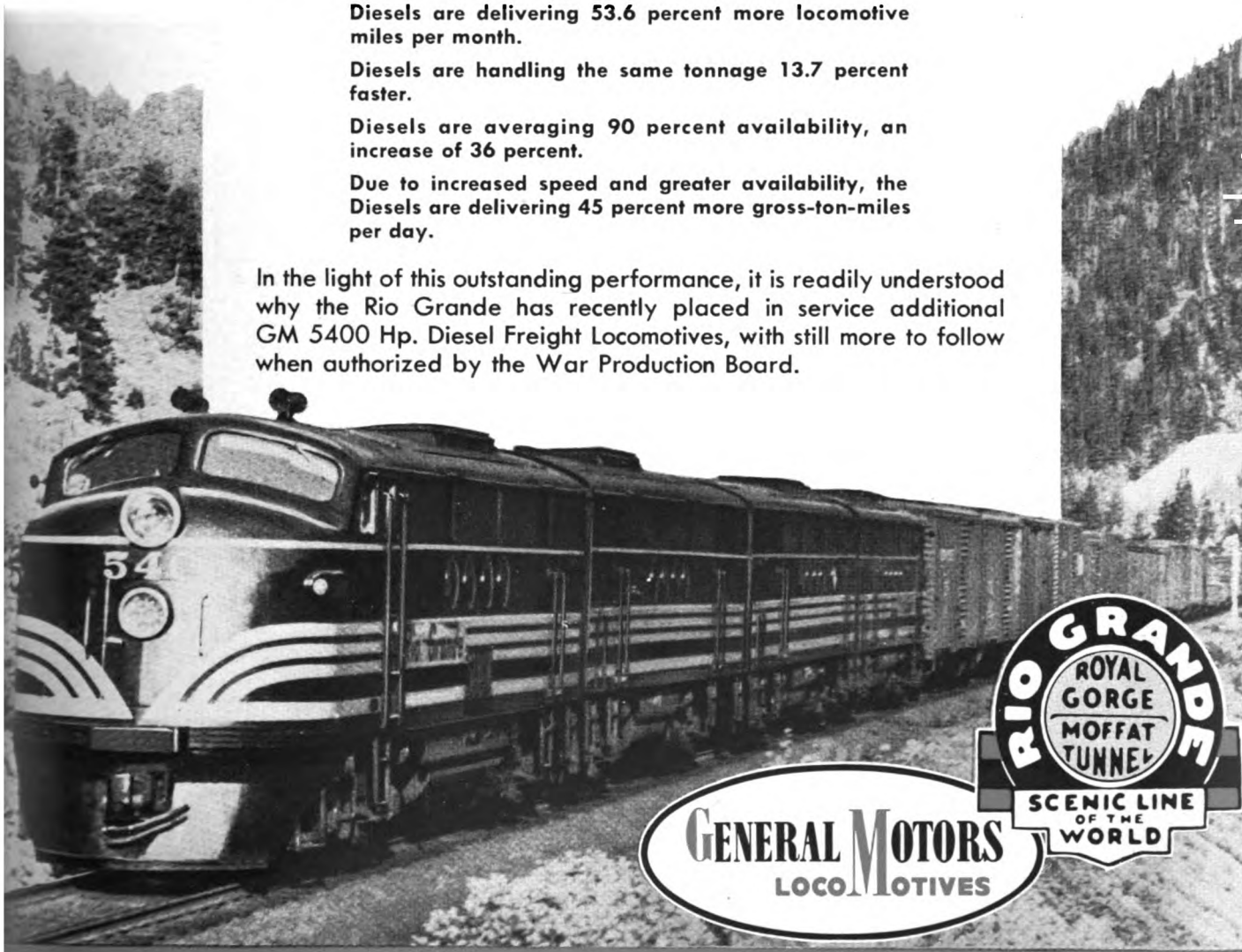
Diesels are delivering 53.6 percent more locomotive miles per month.

Diesels are handling the same tonnage 13.7 percent faster.

Diesels are averaging 90 percent availability, an increase of 36 percent.

Due to increased speed and greater availability, the Diesels are delivering 45 percent more gross-ton-miles per day.

In the light of this outstanding performance, it is readily understood why the Rio Grande has recently placed in service additional GM 5400 Hp. Diesel Freight Locomotives, with still more to follow when authorized by the War Production Board.



ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION LA GRANGE, ILLINOIS, U.S.A.

appointed mechanical engineer of the Canadian National at Toronto and in 1923 was transferred to Montreal. He became chief mechanical engineer of the system in 1940. Mr. Connal has participated in many studies pertaining to locomotive design. His suggestions for reducing the loss of pressure between boiler and cylinders with consequent increase of power and more economical coal consumption aided in the development of the Northern type locomotive.

Master Mechanics and Road Foremen

E. BRANNING has been appointed master mechanic of the Erie, with headquarters at Secaucus, N. J.

MILTON T. LLEWELLYN, whose appointment as master mechanic of the Chesapeake & Ohio at Ashland, Ky., was announced in the August issue, was born in 1886 in York County, Va. He received a grammar school education and entered railroad work on October 6, 1905, as an employee of the Norfolk & Western at Bluefield, W. Va. He served an apprenticeship as a machinist at the Newport News Shipbuilding and Dry Dock Company at New-



M. T. Llewellyn

port News, Va. From October, 1905, until November 6, 1922, he was employed as a machinist successively by the Norfolk & Western, the Baltimore & Ohio, the Seaboard Air Line, the Carolina, Clinchfield & Ohio, the Southern, and the Virginian. He then became an enginehouse foreman and general foreman on the Virginian, entering the service of the Chesapeake & Ohio on November 6, 1922, as a machinist at Hinton, W. Va. He was promoted to the position of assistant enginehouse foreman at Hinton on March 26, 1923, and to general foreman at Rainville, W. Va., on December 16, 1928. As general foreman he was transferred to Newport News on December 1, 1937; to Hinton on January 1, 1940, and to Clifton Forge, Va., on February 22, 1941. He became master mechanic at Ashland on July 1, 1943.

W. J. MCKAY has been appointed master mechanic of the Dominion Atlantic, with headquarters at Kentville, N. S.

PAUL A. BUCKMAN has been appointed master mechanic of the Oklahoma division of the Atchison, Topeka & Santa Fe, with headquarters at Arkansas City, Kan.

A. H. E. PARKES master mechanic of the Canadian National at Calgary, Alta., has been transferred to the position of master mechanic at Edmonton, Alta., with jurisdiction over the Edson division.

J. H. WILSON, master mechanic of the Dominion Atlantic Railway, with headquarters at Kentville, N. S., retired from active service on August 31.

M. J. BRADY, locomotive foreman of the Canadian National at Kindersley, Sask., has been promoted to the position of master mechanic, with headquarters at Calgary, Alta.

Car Department

PAUL B. REICHELDERFER, formerly foreman car inspector of the Reading at St. Clair, Pa., has been promoted to the position of general foreman at Rutherford (Pa.) car shop.

Shop and Enginehouse

H. H. NIEMEYER, acting general boiler inspector of the Chicago, Burlington & Quincy, Lines East of the Missouri river has been promoted to the position of general boiler inspector, with headquarters as before at Chicago.

Obituary

WILLIAM BERGER GEISER, chief chemist at the Collinwood (Ohio) laboratory of



W. B. Geiser

the New York Central, died on August 7 at his home in Cleveland, Ohio. Mr. Geiser was born in Bath, Pa., on November 16, 1878, and was a graduate of Lehigh University in 1902. He entered the Equipment Engineering Department of the New York Central in 1902 at the West Albany (N. Y.) laboratory, and in 1916 took charge of the Collinwood Chemical and Physical Laboratories where he had been in active service since that time. Mr. Geiser had been in the test department for a period of 41 years. He was a member of the American Chemical Institute, the American Society for Metals, and the American Society for Testing Materials.

RAYMOND E. MATTERN, general foreman of the car shop of the Reading at Rutherford, Pa., died on April 15.

R. L. JEFFRIES, former general passenger car foreman of the Cleveland, Cincinnati, Chicago & St. Louis, at Beech Grove, Ind., died on July 12 at his home near Indianapolis, Ind.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

CONTROLLED ATMOSPHERE FURNACES.—Hevi Duty Electric Company, Milwaukee, Wis., ten-page Bulletin HD643. Illustrates and describes Hevi Duty furnaces with which is obtained accurate control of atmosphere conditions for various types of steel heating. Describes the curtain-type furnace with an internal combustion chamber for atmosphere preparation, also the separate gas preparation and gas-cracking units available for use with furnaces utilizing externally prepared atmospheres.

◆

CASTINGS.—National Malleable and Steel Castings Company, Cleveland, Ohio. Thirty-six page illustrated book commemorating the 75th anniversary of the Company. Discusses plants and products, management, and wartime activities of the National Malleable and Steel Castings Company with a chronological statement of developments from its inception in 1868 as the Cleveland Malleable Iron Company, when it made castings for carriages, wagons, and buggies, to its present-day facilities in five separate plants for the manufacture of castings for the railroad, shipbuilding, and automotive industries. Certain types of castings for the aviation industry are now being added.

◆

"ROAD TESTING FREIGHT-CAR TRUCKS."—American Steel Foundries, Chicago. Attractive 32-page booklet illustrates and describes A.S.F. "Service Laboratory," a recent addition to various other research facilities of the company. The laboratory, equipped for the purpose of acquiring accurate, authoritative data for use in the development of new and better high-speed freight-car trucks and other products for the railroads, consists of two standard all-steel box cars completely furnished with scientific instruments. Sections of booklet devoted to The Evolution of A.S.F. "Service Laboratory"; Road Testing High-Speed Freight-Car Trucks 1940-1942; Construction of the A.S.F. Test Cars; Simplified Car Loading; Electrical Equipment, and Scientific Instrumentation.

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MAKE PERFECT CONTACT EVERY TIME

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Anderson Plugs and Receptacles

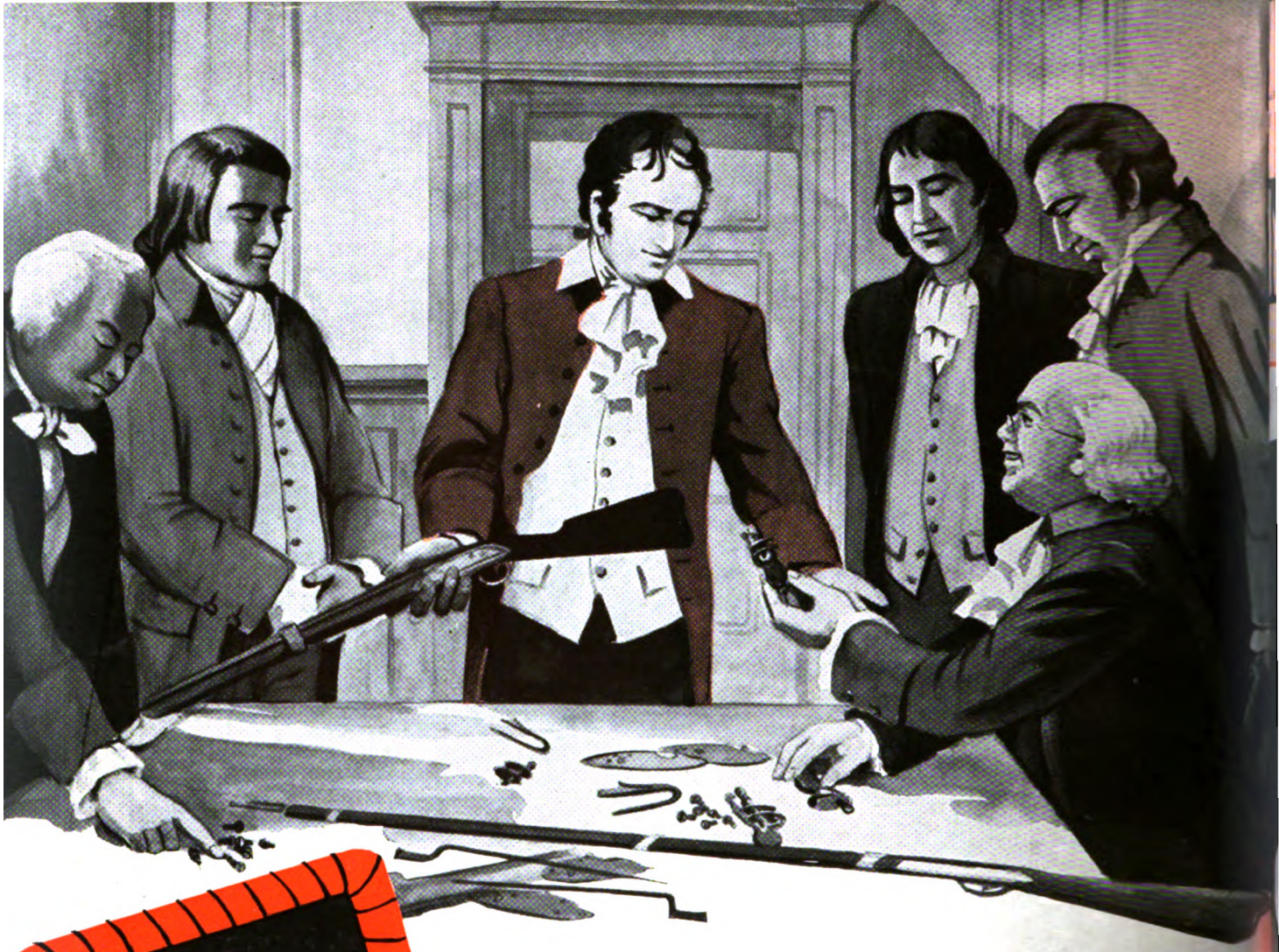
are designed for the following railroad work, Air Conditioning, Battery Charging, Marker Lights, Yard Receptacles, Platform Receptacles, Portable Tools, Telephones, Switchboards, Welding, Cable Connectors, Couplers, Watertight Plugs and Receptacles, Turntables and Industrial Trucks.

ARMY E NAVY

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a lesson from history

The Birth of Precision

● Any schoolboy can tell you what Eli Whitney did for Southern agriculture with his cotton gin. But did you know that this pioneer Yankee craftsman might properly be called the father of modern precision manufacture?

Financial failure of the cotton gin sent Whitney's American ingenuity to work on the manufacture of muskets. Up to that time, each gun and every one of its separate parts were individually shaped. No two parts were alike and if one piece was damaged, a gunsmith shaped a new one from raw stock and filed it until it fitted.

Whitney was the first to make each part exactly like the similar part for other guns and he proved his point by taking ten pieces of each part of a musket to Washington with him when he went in quest of a government contract. While bewigged officials looked on in amazement, he picked parts at random from the heap and put together ten muskets. Incidentally, he won a contract.

We say incidentally, because what Whitney did that day in 1798 gave birth to modern precision — the same precision that is found today in the manufacture of LeBLOND LATHES. Now, 145 years after Whitney's historic trip to his nation's capital, that same precision is a major factor in winning the war.

LeBLOND CINCINNATI, OHIO U.S.A.

THE R. K. LeBLOND MACHINE TOOL CO. • CINCINNATI, OHIO

Largest Manufacturer of a Complete Line of Lathes

October 1943

OCT 1 1 1943

Railway Mechanical Engineer

With which is incorporated RAILWAY ELECTRICAL ENGINEER

SAVE 1500 LBS. of CRITICAL STEEL

...ON A 16 DOOR COMPOSITE GONDOLA!



WINE



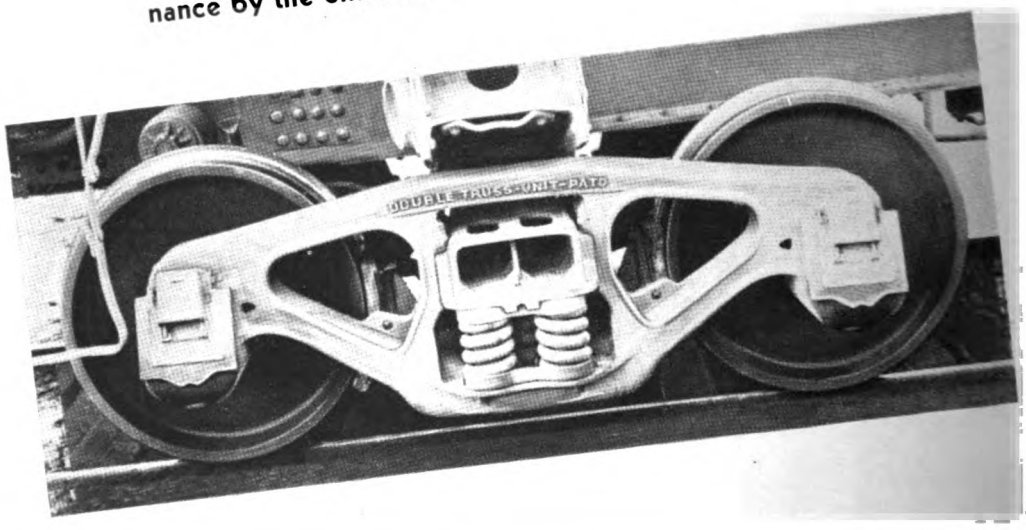
THE WINE RAILWAY APPLIANCE CO.
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WINE DOOR LOCKS

UNIT TRUCK
THE FIRST CHOICE of MANY R.R. MEN



It is not chance that prompts railroad officials to specify Unit Trucks for their freight equipment. They know that Unit Trucks definitely reduce maintenance by the elimination of many troublesome parts.



UNIT TRUCK CORPORATION

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Published monthly by Simmons-Boardman Publishing Corporation, 1309 Noble Street, Philadelphia, Pa. Entered as second-class matter, April 3, 1933, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription price, $3.00 for one year, U. S. and Canada. Single copies 35 cents. Vol. 117, No 10.

ADECO

NOZZLE TESTER



FOR DIESEL ENGINES

KEEP DIESEL ENGINES RUNNING AT PEAK EFFICIENCY

With this sturdy, portable, lightweight Adeco Nozzle Tester, any mechanic can easily make quick, accurate tests on injector opening pressure, spray pattern, etc.; and detect stuck needle valves and leakage around valve seats. Adeco advantages have made this America's most widely used nozzle tester. Tests both large and small injectors, on bench or engine. Avoids costly delays and possible damage to engine. Keeps diesels operating at peak efficiency.

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ARE BETTER-BUILT to drill faster . . . last longer



TRY SKILSAW DRILLS on your toughest jobs, and you'll see why you need them *now* . . . when tools must last longer . . . and help fewer men get more work done! SKILSAW DRILLS have *extra* power for *extra* speed on all drilling, boring, reaming . . . in car shops, locomotive shops, rip tracks and round-houses. And SKILSAW DRILLS operate for less because they're better-built, but they *cost no more than ordinary drills!*

SKILSAW DRILLS are available in many models . . . a size and type for every job . . . all light, compact, easy to handle. Ask your distributor to demonstrate SKILSAW DRILLS *today!*



DRILL STAY-BOLT TELL-TALE HOLES FASTER WITH ¼ IN. SKILDRILL!

Handles like pointing a finger . . fills the hand with drilling power. Ideal for top-speed, day-long drilling . . . cleaning out tell-tale holes, etc.

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THE EDITOR'S DESK

LOOKING AHEAD

Transportation, industrial and commercial interests are all looking forward to the close of the war and our return to more normal conditions. Authorities, generally, seem to agree that the post-war national income will be in the neighborhood of one hundred billion dollars. In 1941, when it was ninety-five billion, the railways earned one billion dollars net operating income and placed heavy orders for cars and locomotives. Because of government restrictions they were unable to get delivery on all of this equipment and they have had comparatively little since. One of the best comments on post-war railway supply business possibilities was recently made by Samuel O. Dunn, chairman of the Simmons-Boardman Publishing Corporation and editor of the Railway Age. Speaking before the Advertising Club of St. Louis he said:

"If the annual national income is as much as one hundred billion dollars, there are three good reasons why the orders placed by the railways in the early post-war years probably will largely exceed those they placed in 1941.

"*First*, because of government restrictions on the equipment and materials they can get, a large part of the earnings they would otherwise now be spending will be carried over and available after the war.

"*Second*, because of these restrictions, and the unprecedented volume of traffic being handled, their equipment and other facilities are being worn out and rendered obsolete faster than ever before. They will have more money with which to buy, and more need to buy, than in many years.

"*Third*, there began before and has been occurring during the war, great progress in the development of improved materials. By renewing and increasing their buying of these materials, the railways can effect great improvements in their passenger and freight equipment, in their tracks and other structures, and in their service."

Roy V. Wright

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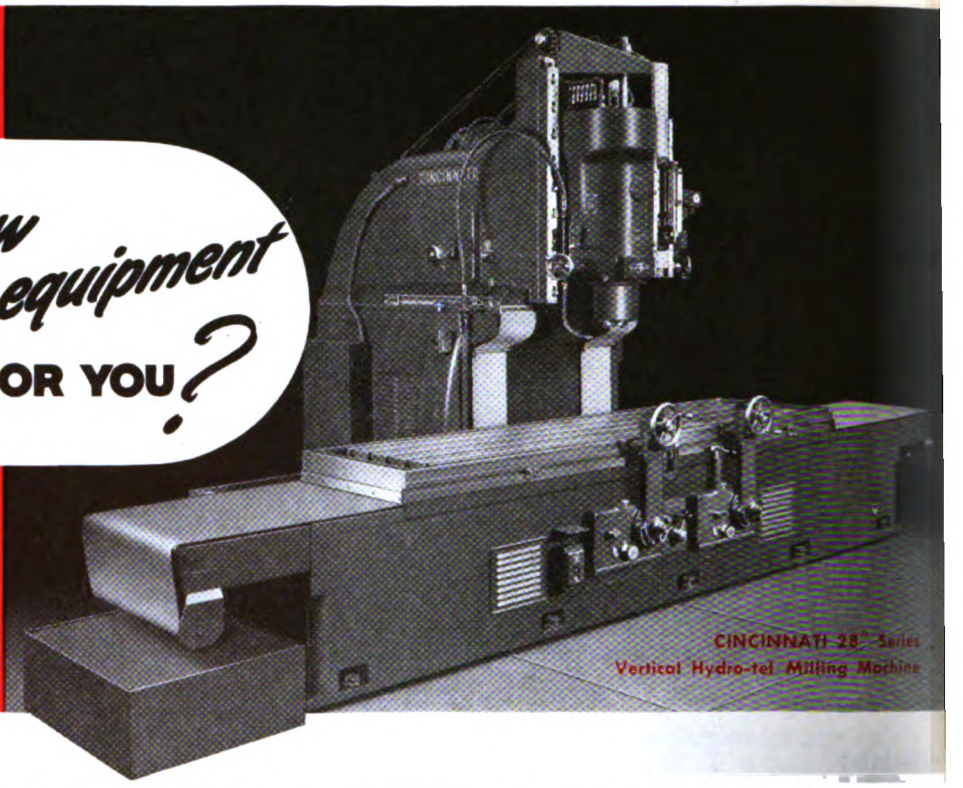
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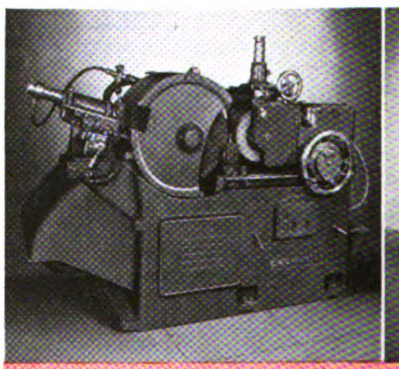
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New Haven Receives Five More

A. C. Electric Locomotives*

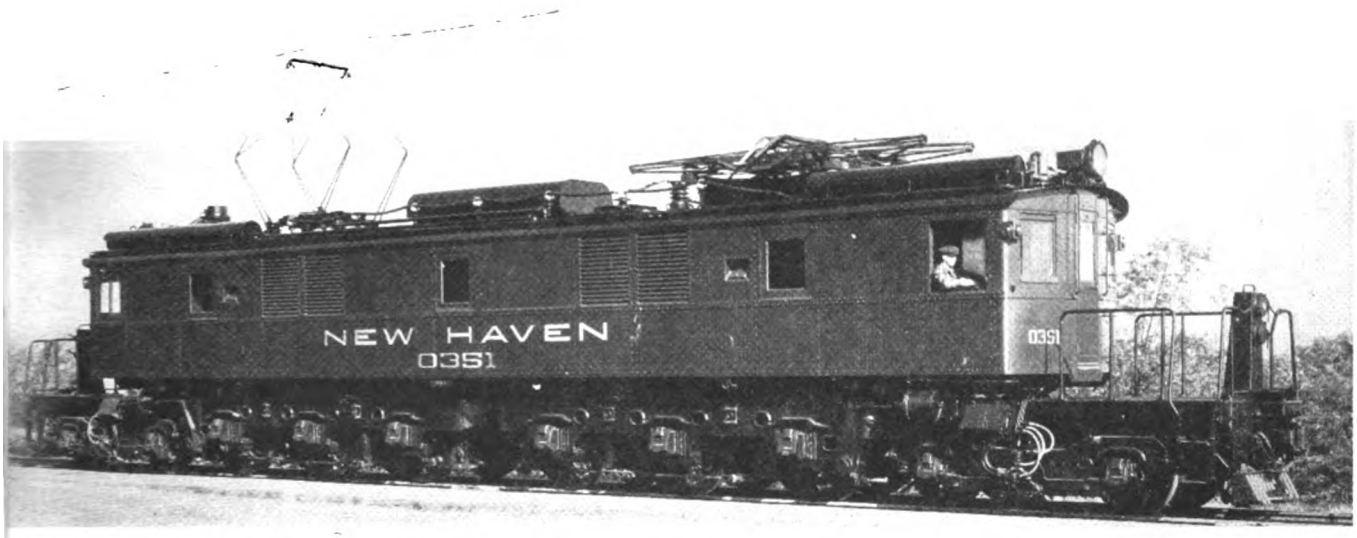


Fig. 1—One of the series 0351 passenger locomotives placed in service in 1931

By T. F. Perkinson† and Robert Walsh†

Comparison of three types shows trend of development during the past ten years

THE recent delivery of five 11,000 volt a. c. electric freight locomotives, built by General Electric for the New York, New Haven & Hartford, marks the latest step in a 12-year program of securing fast, high-powered motive power for the railroad's electrified territory. The prototype of the latest locomotives is the 2-C + C-2 unit (Fig. 1), ten of which were built at the Erie Works of the General Electric Company for passenger service in 1931. These units, equipped for 11,000-volt a. c. and 660-volt d. c. operation, were followed six years later by six streamlined units (Fig. 2), also intended for passenger-train service and arranged for a. c.-d. c. operation.

Within the past year the railroad has acquired ten large a. c. freight locomotives, five of which were furnished by General Electric. One of these is shown in Fig. 3. Table I compares the salient characteristics of the three sizes of General Electric locomotives and indicates clearly the trend to heavier axle loadings and greater horsepowers incorporated in single cab units.

The top speed-tractive force characteristics and the corresponding wheel horsepower characteristics of the three classes of motive power are compared in Fig. 4.

The latest units are similar in appearance to those furnished in 1938—indeed, the similarity is so striking that from a distance one class of locomotive may be very readily mistaken for the other. The same treatment of streamlining and decorative finishing has been employed on both classes of locomotives.

The new locomotives are intended primarily for freight service, but may be employed with heating trailers in passenger service in the a. c. territory. Should traffic conditions warrant, the locomotives at some future date may be re-geared for a higher top-speed and train-heating equipment added. Removable ballast has been supplied initially and occupies the space that will be required for oil-and-water tanks and boilers in train-heating

* Five locomotives of the same type supplied by the Westinghouse Electric & Manufacturing Company were described in the October, 1942 issue of *Railway Mechanical Engineer*. This article compares the three most recent types of New Haven electric locomotives and supplies supplementary information.

† Transportation division, General Electric Company, Erie, Pa.

service. The running-gear has been designed to permit of operating a top speed of 90 m. p. h. with re-geared traction motors.

The heavier axle loading—60,000 lb. per driving axle initially with provision for increasing this to 62,000 lb.—is permitted because the new locomotives, designed for 11,000 volt a. c. operation only, will not be operated in the 660-volt d. c. territory which includes the New York Central's Park Avenue viaduct with its rigid bridge-loading restrictions.

The New Haven's specifications covering the 0155 class stipulate the handling of 125-car freight trains of 5,000 tons (non-adjusted) between Bay Ridge, N. Y., and Cedar Hill yard in New Haven, eastbound, with helper assistance out of Bay Ridge yards, on the Hell Gate Bridge approach and East New York grades, if train operations require a stop on these grades. Westbound performance requires the haulage of 3,000 tons trailing in 75 cars with helper assistance out of Cedar Hill yard and on the West Haven grade if a stop be required on this grade.

Passenger train service is stipulated as being capable of handling a heating trailer and twenty 85-ton Pullman cars between the Pennsylvania Station, in New York City, and New Haven, Conn. (a run of 76 miles) on a 97-minute schedule with two 2-minute intermediate stops and observing all slow-down and speed restrictions. The class 0351 and 0361 units were designed to handle

Table I—Principal Characteristics of the New Haven's Three Latest Types of Electric Locomotives

Year built	1931	1938	194
Number of locomotives	10	6	
Road numbers	0351–0360	0361–0366	0155–015
Service	Passenger	Passenger	Freigh
Wheel arrangement	2-C+C-2	2-C+C-2	2-C+C-2
Weights—total, lb.	402,000	433,200	494,000
On drivers	271,800	272,400	360,000
Per driving axle	45,300	45,400	60,000
On guiding trucks	130,200	160,800	134,000
Wheel base—total, ft.—in.	66–0	66–0	69–4
Driving	37–4	37–4	37–4
Rigid	13–8	13–8	13–8
Length, over couplers, ft.—in.	77–0	77–0	80–4
Heights, pantograph, locked down, ft.—in.	14–6	14–10	15–4
Wheel diameter, driving in.	56	56	5
Guiding	36	36	3
Number twin armature motors	6	6	
Motor type	GEA-621-A-1	GEA-622-A-1	GEA-627-N-
Gear ratio	81/20*	78/23	89/1
Maximum permissible speed, m.p.h.	70	93	6

* As originally supplied these units are currently being equipped with 79/2 gearing for a maximum permissible speed of 80 m.p.h.

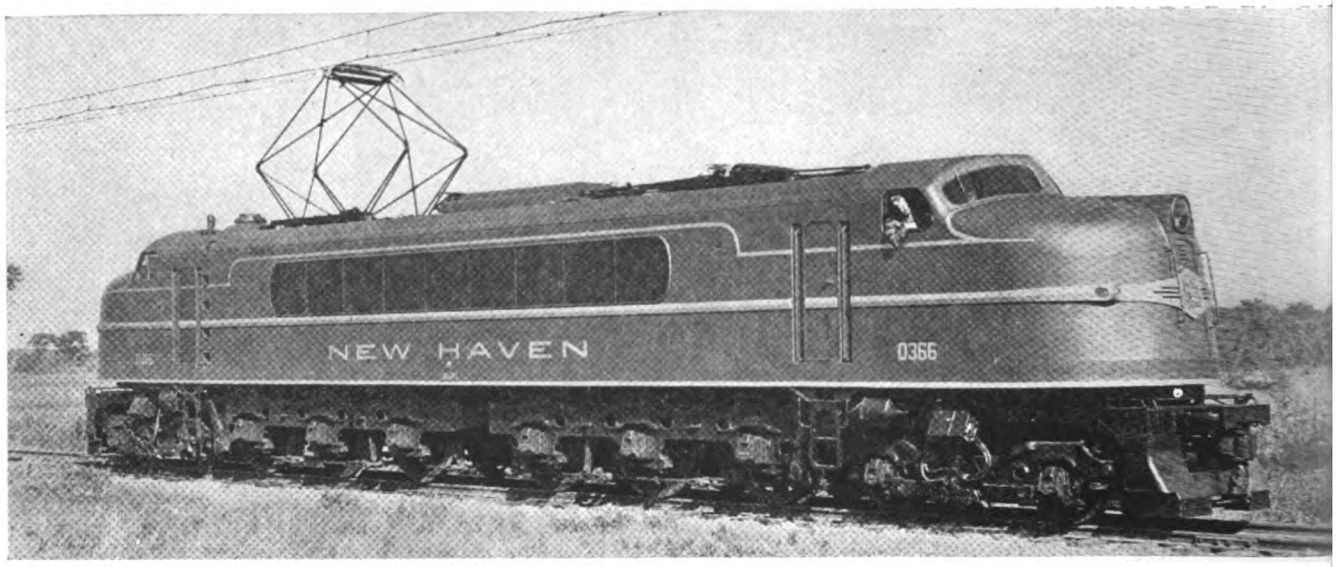


Fig. 2—A series 0361 passenger locomotive delivered in 1938

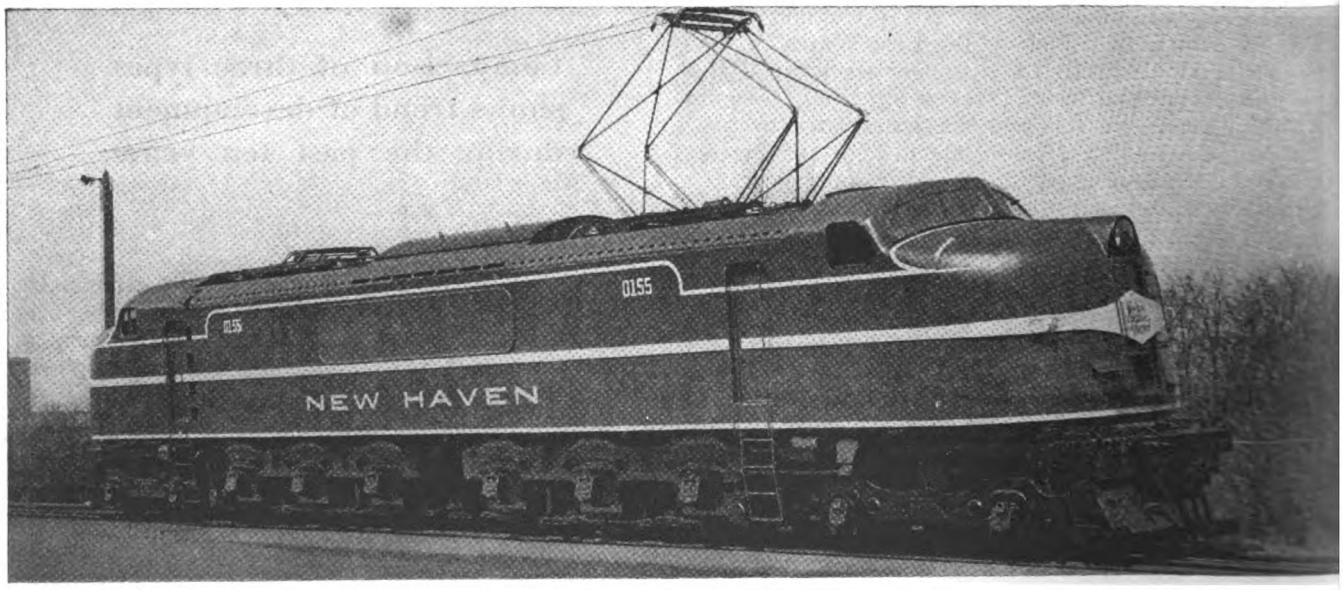


Fig. 3—One of the ten freight locomotives placed in service during the past year

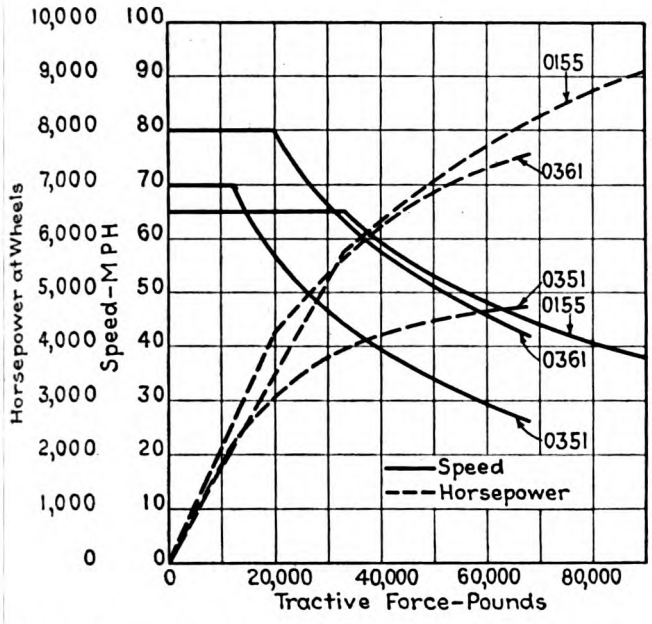


Fig. 4—Comparative characteristics of the three locomotives illustrated. See table for dimensions and ratings

in express service but fifteen 80-ton Pullman cars, the 0361 unit handling this train on a somewhat faster schedule than that obtainable with the 0351 units because of the superior horsepower at speed of the 0361 locomotives.

Tests, on both passenger and freight services, have demonstrated the ability of the 0155 units to meet the specification requirements without difficulty and with leeway ample to insure reliable freight and passenger-train scheduling.

Mechanical Equipment

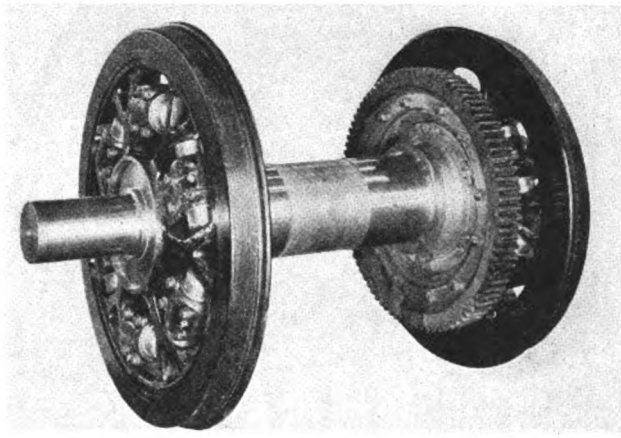
The running gear arrangement is the 2-C + C-2 type which has proved so successful in modern high-speed electric locomotive operation. It consists of two three-axle driving trucks, connected by an articulated joint, and two two-axle guiding trucks. The cab is supported on this arrangement at two center plates, 46 ft. 4 in. apart, and on four spring loading pads which are fitted with shims to permit an adjustment of the weight distribution between the driving and guiding trucks.

It may be found desirable to increase the weight slightly on the guiding trucks if the traction motors are ever re-geared for the maximum speed of the locomotive. This will increase the lateral restraint in the guiding truck swing bolster. In terms of percentage of the weight on the guiding truck, the initial lateral restraint is 27½ per cent, increasing to 32½ per cent with a bolster displacement of 1½ in., after which the restraint decreases gradually to 17 per cent.

In order to insure good riding qualities at the present maximum speed of 65 m.p.h., as well as at any future higher speeds, a guiding truck stabilizer is provided to restrain rotational movements of the guiding truck and a lateral restraint device is provided between the cab and one of the truck frames. Both of these devices are of design similar to those on the 0361 class of locomotive.

The truck frame for each of the guiding trucks and main driving trucks is an integral steel casting. The draft gear is enclosed in an extension of the main truck frame. All buffing shocks are transmitted along the main truck frames and through the articulated joint. In order to allow the locomotive to negotiate curves, one of the center plates is made to slide longitudinally on the truck frame.

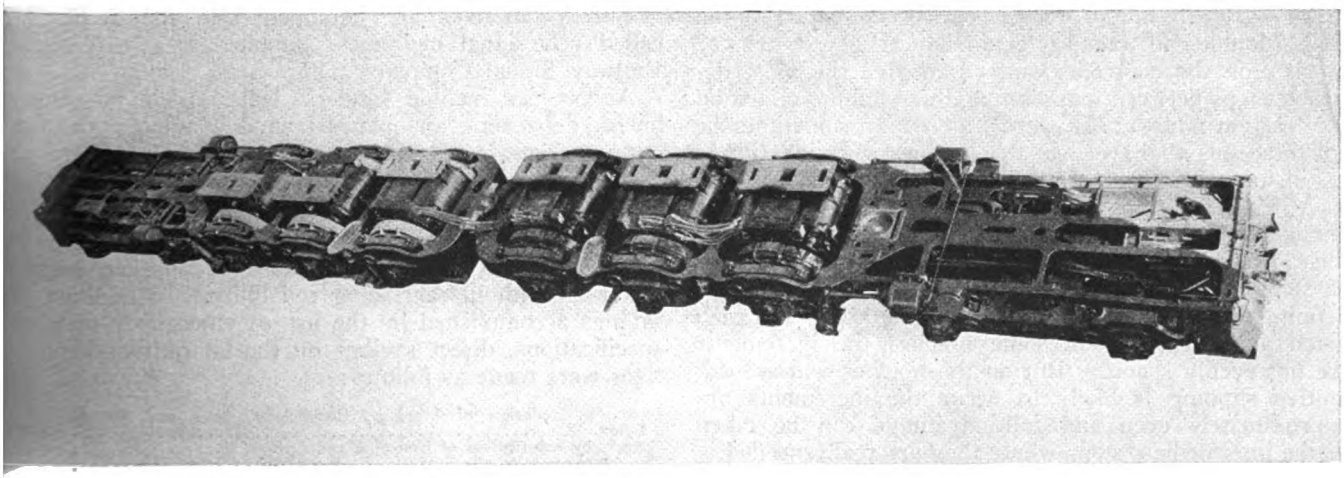
The equalization system is such that each main truck frame is supported on the equivalent of a three-point



Wheel and axle assembly with quill drive and gear

support; the guiding truck center plate is one support, the other two are through the side equalizer base and springs on the main truck frame.

Welding has been used extensively in the fabrication of the cab and cab underframe. The design is similar to that of the 0361 class locomotive in that the contour and details of the cab have been duplicated as closely as



Running gear with driving motors assembled in place

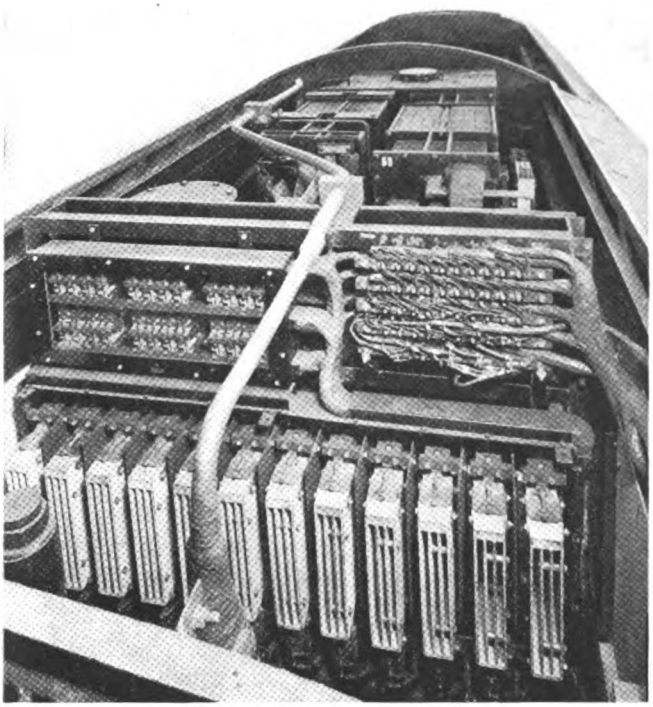
possible. And also, as on the 0361 class of locomotive, an outside truss is employed to strengthen the underframe, thus allowing a maximum amount of space for the equipment.

Electric Equipment

As these locomotives will operate only on the a. c. zone, the electrical equipment is simplified considerably.

There are six GEA-627-N-1 twin-armature, single-phase a. c. motors with commutating and compensating field windings. Each twin motor is capable of exerting 810 hp. continuously. The torque is transmitted to the driving axles through single solid gears mounted on hollow quills and double-end, flexible spring drives, as on the 0361 class.

To reduce the fire hazard to a minimum, Pyranol is used as the cooling medium in the forced-circulation, forced-air-cooled transformer. Taps are taken off the low voltage side of the transformer for voltage control of the traction motors and the operation of the auxiliaries.



Interior view of cab showing apparatus compartments

An extremely fine degree of control is obtained by the PCL double-end control equipment. There are 22 notches on the controller, spaced to give the most desirable steps between minimum and maximum voltage on the traction motors. However, as it may sometimes be advantageous to have available on heavy freight drags a still finer degree of control, there is provided between each of the 22 steps an additional two steps which are obtained by lifting the controller handle vertically and then lowering it to its original position. Thus a total of 66 steps are available though the intermediate steps are definite voltage increments of the same value for each notch and therefore on some notches the increments are not evenly spaced. But on the notches where locomotive slipping is likely to occur the increments are approximately even and full advantage can be taken of the intermediate steps where they are really needed.

Similar to the corresponding a. c. equipment on the 0361 class of locomotive are the two spring-raised, air-lowered, double-pan slider pantograph collectors; the dead-man's release feature; oil circuit breaker; lightning arrester and electro-pneumatic reversers and contactors.

An interesting feature in connection with the protective and operative relays is that they are designed to make contact automatically with their electrical circuits as they are mounted in position. This is accomplished by providing spring contacts as part of the locomotive wiring which make contact with studs on the backs of the relays. Thus the removal of a relay from the locomotive for repair or overhaul is greatly facilitated.

Arrangement of Equipment

Unit assembly of the electrical equipment provides a compact and simple layout, particularly as the control of the traction motors is devoted solely to a. c. operation.

The motor leads from each of the three groups of two twin traction motors in series are brought up into the cab adjacent to the three-motor control units. These motor control units contain the control equipment required by their respective groups of traction motors.

The voltage control unit, comprising the transformer, tap contactors, auxiliary transformer and preventive coils is centrally located in the cab and feeds the three motor-control units.

The auxiliary control unit contains the control equipment required by the various auxiliaries and is mounted at one end of the cab adjacent to the relay cabinet.

Auxiliaries

The locomotive is equipped with two type CPA-32 compressors providing a total displacement of 200 cu. ft. of air a minute. The compressors are driven by a. c. series motors.

Westinghouse No. 8 EL brake equipment is employed.

The two blowers supply a total of 50,000 cu. ft. of air a minute which ventilates the traction motors, the transformer equipment, the blower motors and the motor-control units. In addition, the blowers also separate a large percentage of the dirt and moisture from the incoming air as was done on the 0361 class of locomotive. Experience obtained over a number of years has indicated that the air-cleaning feature is extremely desirable. Two-speed operation of the blowers conserves power and reduces blower noise when full ventilation is unnecessary. The blowers are driven by series-wound compensated commutator type a. c. motors, each of which drives a direct-connected 1½ kw. 32-volt (nominal) d. c. generator for battery-charging and control energy.

The storage battery is of the alkaline type consisting of 25 cells of Edison A4-H battery.

The locomotives are equipped with four-indication coded cab signal equipment supplied by the General Railway Signal Company.

Accessories include sanders, bells, speed indicators, horns, defrosters, air-operated window wipers and fire extinguishers.

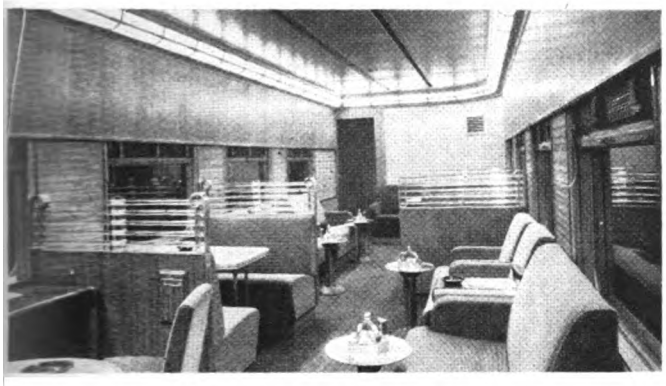
Critical Material Savings

Since the locomotives were built under war-time restrictions, every effort was made to conserve critical materials without sacrificing reliability. In addition to savings accomplished by the use of emergency material specifications, direct savings on the lot of five locomotives were made as follows:

Brass, by redesign of bearings, thrustplates, bells and marker lights, lb.	2,225
Copper, by substitution of iron pipe and fittings, lb.	6,250
Tin, by minimizing the number of soldered joints in wiring, lb.	50
Aluminum, by substitution of iron medallion castings and steel in the pantographs, lb.	600
Rubber, by redesign of hatch cover gaskets, lb.	220

Plastics for the Railroads

THE use of plastics on the railroads is not yet extensive enough so that mechanical engineers and shop supervisors are even fairly familiar with the wide range of products and the variation in properties available in these materials. To many "plastics" is only a word. As a word, it represents, however, as wide a field in chemical and physical properties as is included in the metallurgical properties of the better known metals, alloys, etc. It appears evident that, in the post-war period, there will be an increased use of many of the plastic materials which are now proving themselves in war applications. The



Decorative uses of plastic materials offer a wide range of possibilities for designers—This lounge car shows some of the uses already made

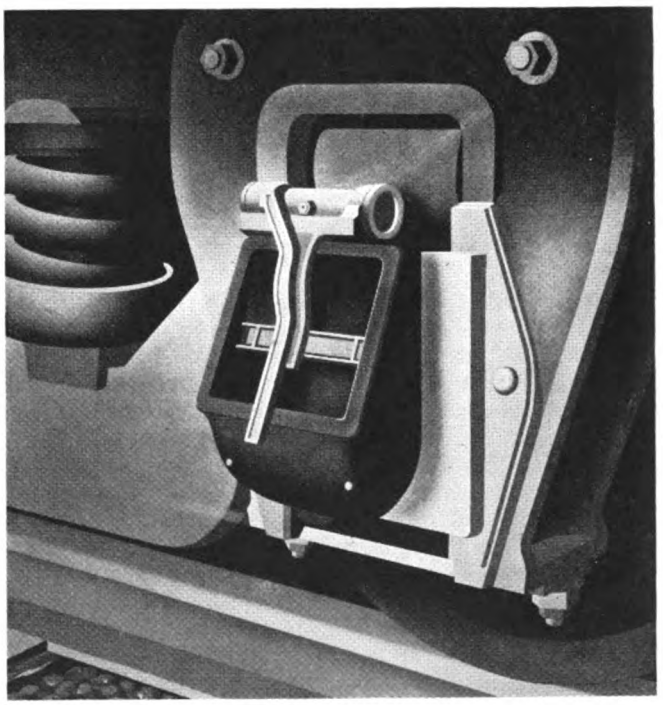
materials will be new and the method of their use will require study; most of them do not fit into patterns set in more familiar designing and engineering. Many of them are, of course, alternate materials which can be employed in place of those now used; others require a thorough understanding of their properties before it can be determined whether their adoption will justify their substitution for what has proved satisfactory in the past.

In the Roundtable discussion in the July issue of the *Railway Mechanical Engineer,* it was made evident that there was considerable interest on the part of railroad men in the prospective uses of plastic materials. It was almost equally evident that few had had sufficient experience with them to be able to estimate the possibilities for further adoption of such products on the railroads. It is also true that, although the manufacturers of plastic products are interested in all possible outlets for their plant capacities after the war, they are not too familiar with the requirements of the railroads. The comment made by a representative of one of the largest manufacturers of basic plastic materials indicates this lack of understanding. "The potential applications of plastics in the railway industry are quite large but we feel that we are going to have to rely on the experience of people in that field for suggestions and developments. We, of course, will be glad to cooperate in any way possible by supplying physical data and special laboratory information concerning our products."

Another writes that, "We consider your industry one which will use more and more plastics as time goes on, particularly the laminated type of high impact strength, and we foresee considerable use of resin bonded plywood in railway car construction after the present emergency. Considerable study of the properties of the several plastics on the market today is of prime importance to railway car designers." A representative of a company which has had long experience in dealing with the requirements of the railroads with respect to signal system insulation approaches the problem of general use in a somewhat different manner. He says, in part, "This company is not considering the railroad field as an unusually important outlet for our materials after the war, simply because we do not have knowledge of specific applications, which, to our mind, would warrant a consistent promotional effort. The field, however, is one of possible use, particularly as engineers engaged in that field will investigate the possibilities of plastics. I would like to offer a suggestion when approaching the subject of plastics. The first job that needs to be done is to make it clear that you cannot speak of plastics as a group of materials having certain properties in common with each other. Thus, in your Roundtable, Mr. Christiansen, when he asks about the shock resistance of plastics, is asking a question too general to be susceptible of a simple answer. One might as well ask what the shock resistance of metals is. The answer, in the case of plastics, is as varied as the answer would be in the case of metals."

What Are Plastics?

Plastics, in the industry, are generally divided into two main groups; thermosetting materials and thermoplastic materials. The thermosetting materials are those which undergo a chemical change when heat and pressure are applied. After forming, their nature is such that they do not soften to any appreciable extent under heat. In this group are included the phenol formaldehyde, phenol



Courtesy Dow Chemical Company

Journal box lid made by the Railway Service and Supply Corp. from Ethocel—This ethyl cellulose material offers many possibilities for molded products when materials are again available

furfural, cast phenolic, melamine formaldehyde and urea formaldehyde materials. The thermoplastic materials undergo no chemical change under heat and pressure although they soften. However, when cool, they harden and can then be reworked as necessary. In this group are included the cellulose acetate compounds, the cellulose acetate-butyrate products, the ethyl cellulose, polystyrene, methyl methycrylate, vinyl chloride-acetates and vinylidene chlorides. Some can be cast, others molded. Some can be produced in sheets, others as tubes or rods, others as fine threads which can be spun and woven into a variety of cloths made to meet either appearance or service specifications. In addition, there are various resins utilized in the manufacture of laminated products or employed to impregnate cloths, papers, etc.

Physical Properties

The various plastics producers, limit themselves in their claims, when presenting the qualities of their products, to known or probable applications. Various enthusiasts envisage a "plastics world" when the war is over but they have no supporters among the technical men engaged in the development of plastic materials.

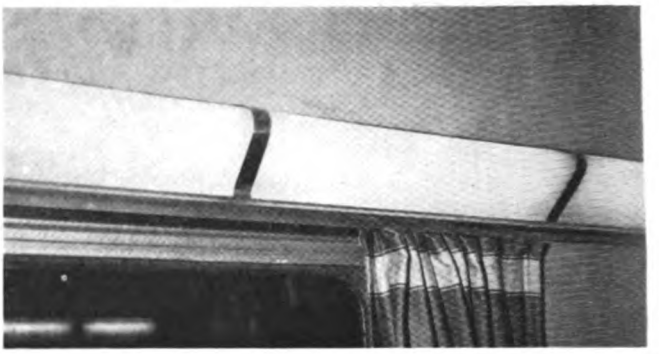


Car interiors have been brightened by the use of plastic products

When given the physical requirements for a material, plastics engineers want to cooperate in developing a product which meets these requirements. In general, it can be said that the phenol-formaldehyde compounds when molded, have a tensile strength of from 4,000 to 18,000 lb. per sq. in.; in the laminated form they vary from 8,000 to 20,000 lb.; when cast the range for grades suitable for electrical or mechanical needs will approach 20,000 lb. per sq. in. Variations in properties of the molded products depends, in part, upon the type of filler used and the same is true for laminated products where consideration must be given to the base material which is used. As fillers for molding, macerated fabrics, woodflour, various mineral type fillers and sisal felt fillers are used. Some molded products are made without any filler material. Laminated products may have a variety of bases, the most common paper and cotton fabrics.

The Plastics Catalog* lists the following as being the generally recognized types of plastics: Phenol-formal-

* Published 1943 by the Plastics Catalogue Corporation, New York.



Lighting fixtures in many cars are being made of plastics which offer a wide range of color characteristics and have good optical qualities

Manufacturers and Trade Names*

PHENOL-FORMALDEHYDE MOLDING COMPOUNDS

Bakelite	Bakelite Corp., New York
Durez	Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.
Durite	Durite Plastics, Philadelphia, Pa.
Heresite	Heresite & Chem. Co., Manitowac, Wis.
Indur	Reilly Tar & Chemical Corp., New York
Insurok	Richardson Co., Chicago
Makalot	Makalot Corp., Boston, Mass.
Neillite	Watertown Mfg. Co., Watertown, Conn.
Resinox	Monsanto Chem. Co., Springfield, Mass.
Textolite	General Electric Co., Pittsfield, Mass.
Co-ro-lite (Sisal)	Columbian Rope Co., Auburn, N. Y.

PHENOL-FORMALDEHYDE LAMINATED PRODUCTS

Aqualite	Nat. Vulcanized Fibre Co., Wilmington, Del.
Celoron } Dilecto }	Continental-Diamond Fibre Co., Newark, Del.
Duraloy	Detroit Paper Products Corp., Detroit
Farlite	Farley & Loetscher Mfg. Co., Dubuque, Iowa
Formica	Formica Insulation Co., Cincinnati, Ohio
Insurok	Richardson Co., Chicago
Lamicoid	Mica Insulator Co., New York
Micarta	Westinghouse Electric & Mfg. Co., Trafford, Pa.
Ohmoid	Wilmington Fibre Specialty Co., East Wilmington, Del.
Panelyte	Panelyte Corp., New York
Phenolite	Nat. Vulcanized Fibre Co., Wilmington, Del.
Spauldite	Spaulding Fibre Co., Tonawanda, N. Y.
Synthane	Synthane Corp., Oaks, Pa.
Taylor	Taylor Fibre Co., Norristown, Pa.
Textolite	General Electric Co., Pittsfield, Mass.
Ucinite	United-Carr Fastener, Cambridge, Mass.

PHENOL-FORMALDEHYDE CAST PLASTICS (no filler)

Bakelite	Bakelite Corp., New York
Baker Resin	Baker Oil Tools, Inc., Los Angeles, Calif.
Catalin	Catalin Corp., New York
Gemstone	A. Knoedler Co., Lancaster, Pa.
Marblette	Marblette Corp., Long Island City, N. Y.
Opalon	Monsanto Chem. Co., Springfield, Mass.

PHENOL-FORMALDEHYDE CAST (Asbestos filler)

Haveg	Haveg Corp., Newark, Del.

PHENOL-FURFURAL RESINS

Durite	Durite Plastics, Philadelphia, Pa.

UREA-FORMALDEHYDE COMPOUNDS

Bakelite	Bakelite Corp., New York
Beetle	American Cyanamid Co., New York
Cibanoid	Ciba Co., Inc., New York
Plaskon	Plaskon Co., Inc., Toledo, Ohio
Uformite	Resinous Prod. & Chem. Co., Philadelphia

MELAMINE-FORMALDEHYDE COMPOUNDS

Catalin Type	Catalin Corp., New York
Melmac	American Cyanamid Co., New York
Plaskon Type	Plaskon Co., Inc., Toledo, Ohio

ANILINE-FORMALDEHYDE RESIN

Cibanite	Ciba Co., Inc., New York
Dilectene	Continental-Diamond Fibre Co., Newark, Del.

LIGNIN PLASTIC

Benalite	Masonite Corp., Laurel, Miss.
Lignolite	Marathon Chemical Co., Rothschild, Wis.

VULCANIZED FIBRE

Diamond Fibre	Continental-Diamond Fibre Co., Newark, Del.
National	Nat. Vulcanized Fibre, Wilmington, Del.
Taylor	Taylor Fibre Co., Norristown, Pa.
Vulcoid	Continental-Diamond Fibre Co., Newark, Del.

COLD-MOLDED—Bituminous type (non-refractory)

Aico	Amer. Insulator Corp., New Freedom, Pa.
Amerine (phenolic)	Amer. Insulator Corp., New Freedom, Pa.
Cetec—non-refractory	General Electric Co., Pittsfield, Mass.
Ebrok	Richardson Co., Chicago
Gummon	Garfield Mfg. Co., Garfield, N. J.
Okon	American Hard Rubber Co., New York
Thermoplax	Cutler-Hammer, Inc., Milwaukee, Wis.

COLD-MOLDED—Ceramic type (refractory)

Aco—5	Amer. Insulator Corp., New Freedom, Pa.
Alphide	Standard Plastics Corp., Jersey City
Cetec—refractory	General Electric Co., Pittsfield, Mass.
Coltstone	Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Hemit	Garfield Mfg. Co., Garfield, N. J.

CASEIN

Ameroid	American Plastics Corp., New York
Galorn	Geo. Morrell Corp., Muskegon Heights, Mich.

SHELLAC COMPOUND

Complac	Poinsettia Inc., Pitman, N. J.
Compo-Site	Compo-Site Inc., Newark, N. J.
Harvite	Siemon Co., Bridgeport, Conn.
Lacanite	Consolidated Molded Products Corp., Scranton, Pa.

VINYL CHLORIDE ACETATE RESINS

Vinylite	Carbide & Carbon Chem. Corp., New York

VINYL CHLORIDE RESINS

Koroseal	B. F. Goodrich Co., Akron, Ohio
Vinylite	Carbide & Carbon Chem. Corp., New York

VINYLIDENE CHLORIDE RESINS

Saran	Dow Chemical Co., Midland, Mich.
Mills plastic	Elmer E. Mills Corp., Chicago
Vec	Pierce Plastics Inc., Bay City, Mich.
Velon	Firestone Rubber & Latex Co., Fall River, Mass.

VINYL BUTYRAL RESIN

Butacite	E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.
Butvar	Shawinigan Products Corp., New York
Saflex	Monsanto Chem. Co., Springfield, Mass.
Saflex TS	Monsanto Chem. Co., Springfield, Mass.
Vinylite X	Carbide & Carbon Chem. Corp., New York

VINYL ALCOHOL RESIN

PVA	E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.
Resistoflex	Resistoflex Corp., Belleville, N. J.

METHYL METHACRYLATE

Crystalite	Rohm & Haas Co., Inc., Philadelphia, Pa.
Lucite	E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.
Plexiglas	Rohm & Haas Co., Inc., Philadelphia, Pa.

POLYSTYRENE

Bakelite	Bakelite Corp., New York
Loalin	Catalin Corp., New York
Lustron	Monsanto Chem. Co., Springfield, Mass.
Styron	Dow Chemical Co., Midland, Mich.

NYLON RESINS

Nylon	E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

RUBBER COMPOUNDS

Chlorinated rubber

Marbon	Marbo Products Corp., Chicago
Parlon	Hercules Powder Co., Wilmington, Del.

Modified isomerized rubber

Plioform	Goodyear Tire & Rubber Co., Akron, Ohio
Pliolite	Goodyear Tire & Rubber Co., Akron, Ohio

Hard rubber

Ace	American Hard Rubber Co., New York
Luzerne	Luzerne Rubber Co., Trenton, N. J.
Rub-tex	Richardson Co., Chicago

ORGANIC POLYSULFIDES

Thiokol	Thiokol Corp., Trenton, N. J.

CELLULOSE COMPOUNDS

Ethylcellulose

Ethocel	Dow Chemical Co., Midland, Mich.
Hercules E.C.	Hercules Powder Co., Wilmington, Del.

Cellulose acetate

Bakelite	Bakelite Corp., New York
Herculoid	Hercules Powder Co., Wilmington, Del.
Fibestos	Monsanto Chem. Co., Springfield, Mass.
Lumarith	Celanese Celluloid Corp., New York
Nixonite	Nixon Nitration Works, Nixon, N. J.
Plastacele	E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.
Tenite I	Tenn. Eastman Corp., Kingsport, Tenn.

Cellulose acetate butyrate

Tenite II	Tenn. Eastman Corp., Kingsport, Tenn.

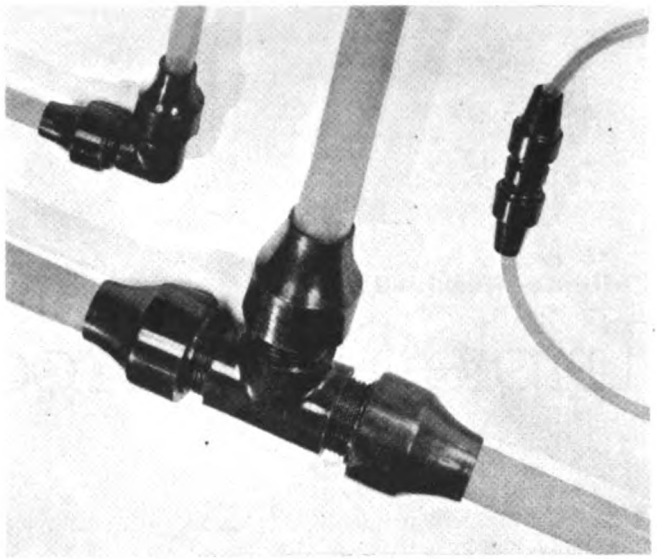
Cellulose nitrate

Celluloid	Celanese Celluoid Corp., New York
Nitron	Monsanto Chem. Co., Springfield, Mass.
Nixonoid	Nixon Nitration Works, Nixon, N. J.
Pyralin	E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.
Hercules C.N.	Hercules Powder Co., Wilmington, Del.

dehyde compounds; phenol-furfural compounds; urea-formaldehyde compounds; melamine-formaldehyde compounds; aniline-formaldehyde resin; lignin plastic (laminated); vulcanized fibres; cold molded products, either organic or inorganic, the organic being non-refractory in nature, the inorganic being a refractory material; casein products, shellac compounds; vinyl chloride acetate resins; polyvinol acetate resins; polyvinol chloride resins (plasticized); vinylidene chloride resins (molding); polyvinol butyral resins; polyvinol alcohol; methyl methacrylate resin; polystyrene; nylon resins (molding); rubber compounds; organic polysulfide molding compound; and, cellulose compounds.

Within this wide range of available materials there exists the prospect for development of many products which could be used in the railway locomotive and car fields. Physical properties vary widely, depending on the type of plastic material employed. Some excel in properties demanded for structural uses; others for those in purely decorative uses. Those which are to be used in electrical applications must be selected in the light of their dielectric properties and adopted or rejected after study. Particularly important, in the case of some plastic materials, is their water absorption factor.

Other characteristics must be taken into account when considering the adoption of a plastic product in place of a previously used material. There is, for example, the need for determining the effect that age, sunlight, acids or alkalies, in their various strengths, will have upon the material chosen. The possibilities in color selection and in clarity of the materials must, sometimes, be known before selections can be made.



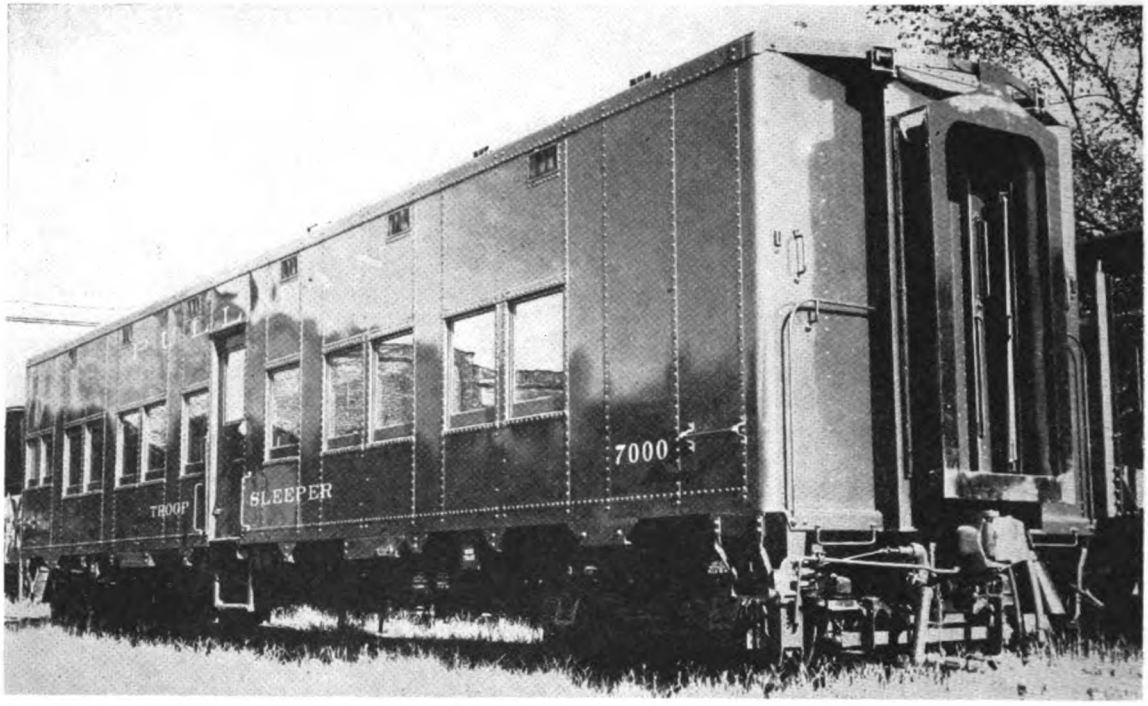
Rigid and flexible type tubings, with needed fittings, are being manufactured

Selecting A Plastic

In general, it can be said that the primary characteristics of interest to designers and engineers will be the factors of weight, impact strength, tensile strength, compressive strength, moisture resistance and electrical properties. Certain types of plastics have a high rating in some of these qualities, other materials excel in others. The aircraft industry has found that a number of plastics are suitable for use in non-structural applications and provide a considerable saving in weight. The fairly high strength-weight ratio of many seems to offer a field for investigation in the designing of railway equipment. Some of the plastics are valuable in damping out vibratory stresses.

Laminated phenolics are highest in the factors which are of most interest in a structural material. Tensile strength, depending upon the method of manufacture approaches 20,000 lb. per sq. in., compressive strength about 44,000 lb. per sq. in., and impact strength about 8.0 under the Izod test using a ½-in. by ½-in. notched

(Continued on page 459)



Pullman-Standard Builds

Triple-Deck Troop Sleepers

The cars, based on standard box-car design, have berths for 30, Passenger-car trucks and complete equipment for operation in passenger trains—Weight, 76,300 lb.

THE first of 1,200 triple-deck troop sleeping cars, the construction of which is based on a standard A. A. R. steel-sheathed box car, was previewed at Washington, D. C., by officers of the Transportation Corps of the Army Service Forces on September 4. The production schedules call for completion of the order by the first of next year. The cars are being built by the Pullman-Standard Car Manufacturing Company and will be operated and maintained by the Pullman Company in arrangements approved by the Army Transportation Corps and the Association of American Railroads.

The cost of building these cars will be a small fraction of the cost of a standard Pullman sleeping car. The character of the service which they will render, however, will be along standard Pullman Company lines. This was made clear in a memorandum to Pullman car-service employees written by Fred Callahan, general manager of the Pullman Company, preparatory to their operation, which reads in part as follows:

"Our service in these cars is to conform in every respect to the customer service you are accustomed to deliver in connection with the regular Pullmans. These cars will bear the name Pullman. They will be serviced with linen and other supplies in the same manner as all other Pullmans. There will be a berth for every man and bedding will be changed nightly by the porter. The kind of service on which we have built our reputation will be the same in every possible respect. In other words, all of the operating procedures which we employ with respect to all of our cars will be in effect in full in the case of the new troop sleepers."

The new Pullman double-deck sleeper is primarily of riveted carbon-steel construction with heavily reinforced ends and weighs 76,300 lb. The design is based on that of the A. A. R. standard 50-ft. 6-in. steel-sheathed box car. The length over buffers, coupled, is 54 ft. 2½ in. The cars are 9 ft. 1⅜ in. wide inside and 9 ft. 9⅝ in. over the side sills. The height inside at the center is 9 ft. 5 in. Truck centers are spaced 40 ft. 8½ in.

The structure has been modified to accommodate the windows in the sides and the side doors and step wells which break the continuity of the bottom chord member of the car side. Most of the intermediate side posts are 3-in. 5.1-lb. rolled Z-bars. Others, however, are of $\frac{3}{16}$-in. pressed plate, as are also the side-door and corner posts. The pressed-steel intermediate posts are applied in the narrow pilasters between the windows in each pair.

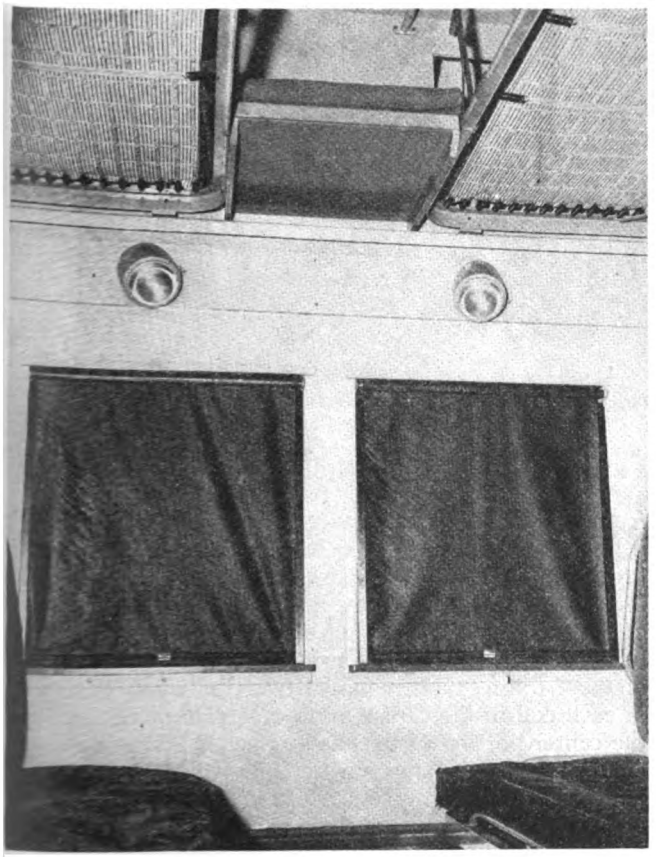
Because of the interruption in the side structure of the car caused by the side doors and step wells, a 7-in. 18.8-lb. car channel is attached below the side-sill be-

tween the cross-bearers at the center of the car and pressed inward to extend around the back of the step well where it forms the riser of the top step. The top flange of this channel is riveted securely to the horizontal flange of the side-sill angle. The sides of the step well are closed with pressed pans.

The flooring, except at the ends of the car, is 1¾-in. by 5$\frac{1}{16}$-in. tongue-and-groove material which is applied across the car the same as on a freight car and is bolted directly to the side sills and floor stringers. At the ends the floor forms a raised platform nailed to wood fillers which are placed on top of the intermediate stringers to conform to standard passenger-car floor height. The top flooring is brown asphaltum tile, $\frac{3}{16}$ in. thick, cemented directly to the wood flooring. A sloping ramp is provided in the aisle at each end leading to the elevated floor. This is covered with a non-slip metal tread.

The walls and ceilings are insulated with a 1-in. blanket. The insulation is secured to the side and end sheathing by means of nails welded to the sheets. The ceiling insulation is cemented directly against the roof sheets. The floors are not insulated.

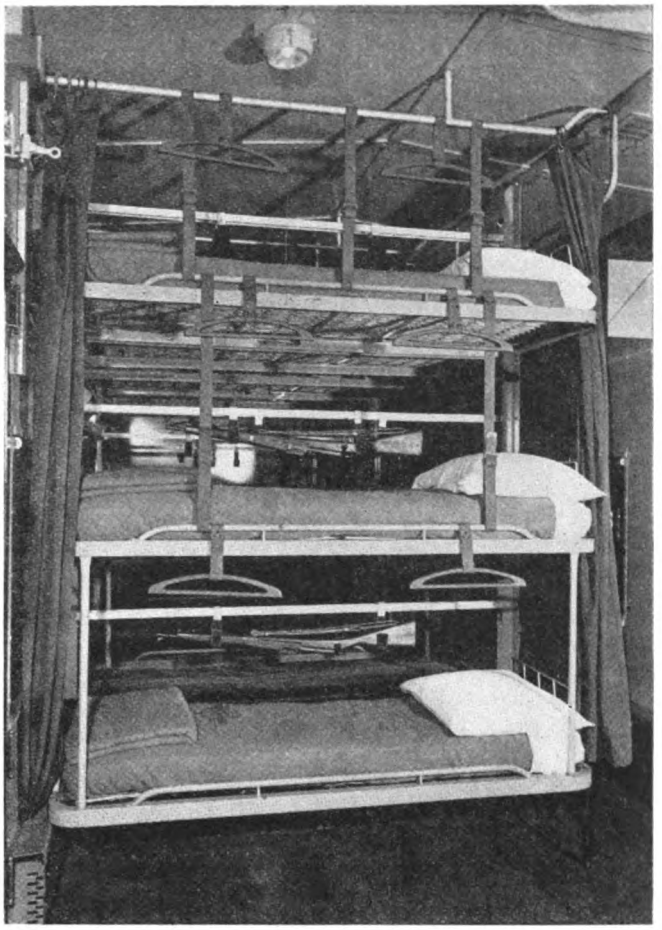
The car is designed for full service interchangeability with all other cars, is equipped with high-speed passenger-train-car trucks and springs, and therefore can be operated in any type of passenger train. The end doors are similar to those on standard railway passenger cars. There are no vestibules, but each car is fitted with passenger-car diaphragms and face plates with semi-elliptic upper spring arrangement and side buffer stems behind the bottom buffer face plate. At each end is an anti-climbing arrangement which interlocks between the cars when coupled under full compression and is designed to resist a vertical load of 130,000 lb. within the yield point of its parts and attachments.



ach section has two automotive type lamps with diffusing type cover glass

The cars are equipped with two AB-1-B type control valves and two 10-in. by 12-in. brake cylinders. The water supply consists of 150 gals. per car stored in overhead flat tanks at each end and with gravity flow. The tanks are filled through water filling nozzles at the side-sill level at each corner of the car and can be quickly and completely drained. An extra layer of insulation is applied over the top and at the ends of each tank and provision is made for circulating warm air from the inside of the car within the boxing around the tanks.

Sliding doors on each side at about the center of the car, with trap doors and steps, facilitate loading and unloading. On each side of the main body of the car there are ten sliding windows about 2½ ft. wide and 3 ft. high. Each window is equipped with roll shades and steel mesh screens. These large windows give ample light in the daytime, and, with the seats arranged for daytime occupancy, clear and unobstructed vision to the outside. Each window is easily raised or lowered so that fresh air may circulate freely throughout the car, as required. In addition to these main car windows, there is a window at each end of the car beside the wash basins and a window in each toilet room.



The berths are made up with standard Pullman bedding—There is a rifle rack for each occupant

Eight exhaust ventilators in the roof and inlet ventilators in the sides near the eaves insure adequate ventilation under all conditions. A low-pressure, vapor heating system, with fin-type radiation, is installed. The heating is controlled by four hand valves, two placed on each side of the car, with stencil markings showing their location. The ceilings and sides of the car are lined with a composition material which makes a smooth interior, painted in three-tone tans.

Passenger Accommodations

When made up for night occupancy, with sleeping accommodations for 30 passengers, each in an individual bed, the car has berths arranged in tiers of three running crosswise, with the aisle along the side instead of in the center as in the conventional sleeping car. The floor is covered with brown asphaltum, designed to be durable and long wearing but soft and springy.

For daytime use, the top berths remain fixed, forming a ceiling for the section and space for the storage of bedding and linen. The middle berth, which is hinged, drops down to form a back for the seat converted from the lower berth. The wide seats thus provided by each lower berth in each section are more than ample for three passengers, affording plenty of leg room and the opportunity for comfortable sitting or lounging positions.

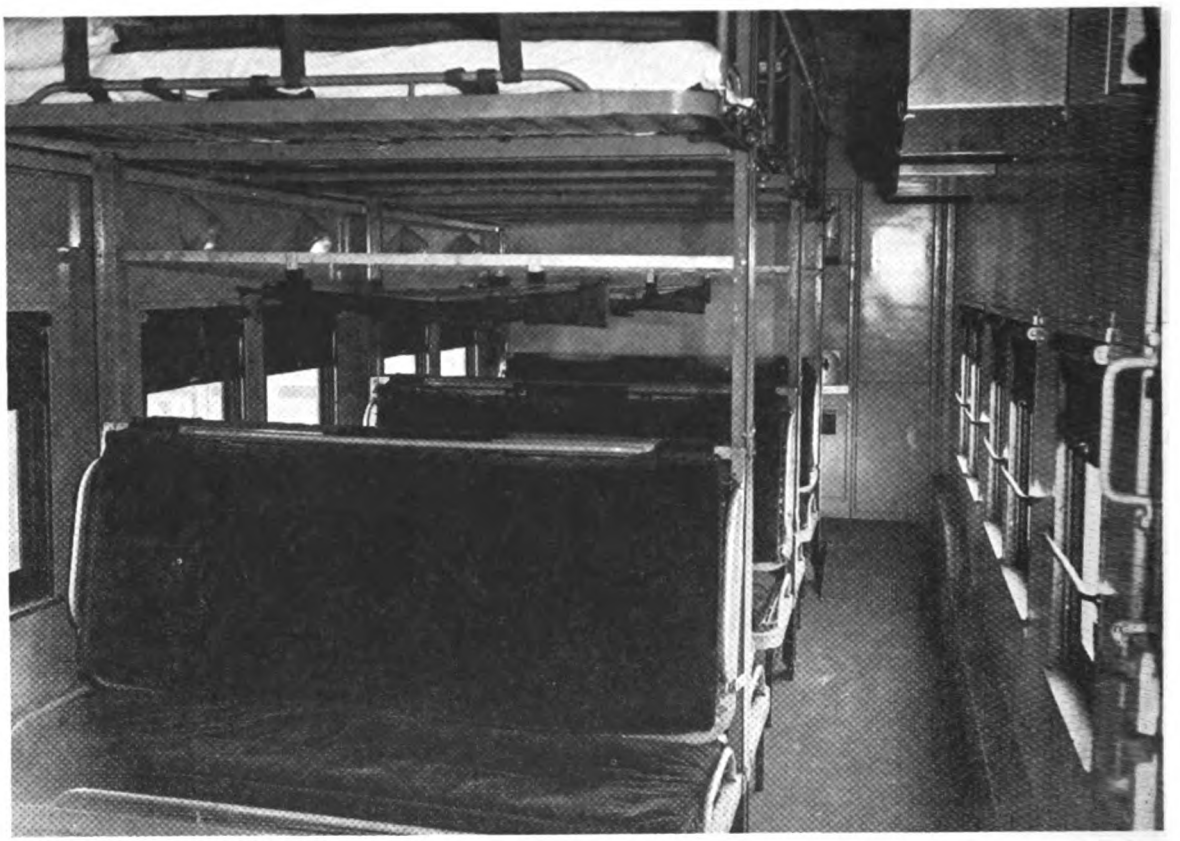
Each berth has a steel bed spring and a mattress, the latter for the lower berth forming the cushion for the seat for daytime use. Each tier of berths has curtains for use when the cars are operated in regular trains or when the cars are occupied by WACS or WAVES, or other women members of the military forces. Pullman fabric guards have been placed on each upper and middle berth. Standard Pullman bedding, consisting of sheets, pillows, pillow cases and blankets, is furnished for each berth and while the cars are in service the linen is changed every night. Two durable wooden coat hangers are permanently attached to each berth. There is also a rack for the soldier's rifle.

There are four wash basins, two at each end of the car, with cold and hot water faucets, and two enclosed toilets, one at each end of the car. Close by the wash basins are the time-honored Pullman razor slot for the disposal of used razor blades. Above the wash basins are wide, deep mirrors, and near by a paper towel dispenser and waste rack for used towels. There is a drinking-water cooler with a dispenser for sanitary drinking cups at one end of the car.

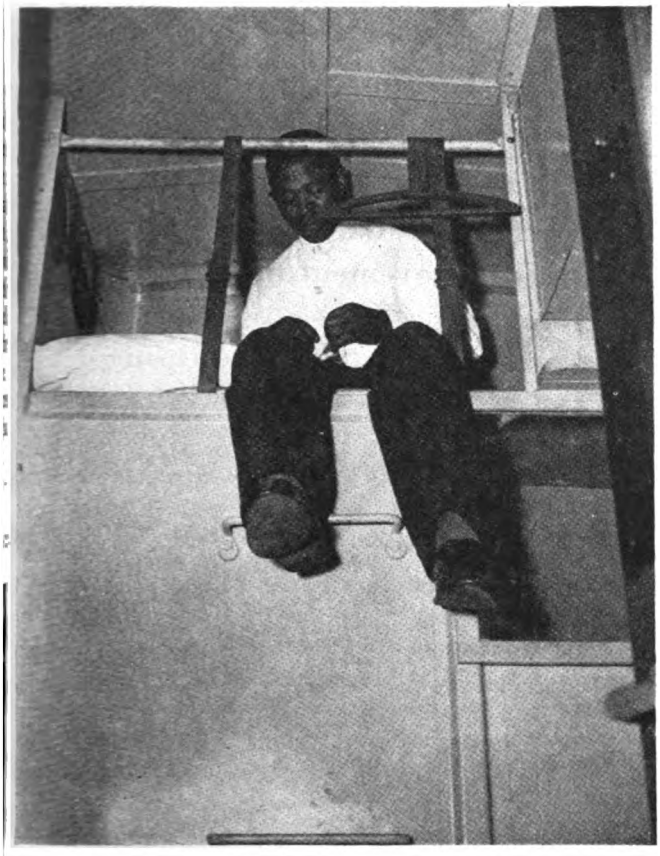
The 30 berths are numbered and when the car is in service one of the end upper berths is reserved for the porter. Two porter's lockers are installed, one at each end of the car, for the storage of linen and other supplies. Between each pair of upper berths there is a rack for the storage of baggage or linen. This is attached to the side of the car at the level of the upper berths, to which it is bolted. The rack projects about 24 in. from the side of the car and does not interfere with access to the berth.

Perforated grilles cover all heating pipes throughout the car. An emergency tool rack, enclosed in glass, is located above one of the side doors for easy accessibility. Two chemical fire extinguishers, enclosed in glass cases, of easy accessibility, are installed in each car. There is also a first-aid package in a locked container on one of the side walls.

The current for the electric-lighting system is furnished from replaceable primary-type batteries without axle generator equipment. The batteries are housed in steel boxes mounted on the side wall, approximately seven feet above the passageway floor. There are 12 fixtures, consisting of a metal casing containing a silverplated reflector, a switch, and a diffusing type of cover glass. Two of these fixtures are mounted over the wash basins, one at each end of the car; two on each side of the ceiling in the center portion of the car between the side doors, and eight arranged in pairs on the side wall in each section. The 5¾-in. light fixtures are of the automotive type. For the night light circuit, there is one ceiling fixture in each toilet, one in front of each end door, and two in the ceiling of each passageway. These have reflectors and glass covers arranged to throw a narrow beam of light on the



The intermediate berth forms the back of the seat during the day—The upper berths remain in night position—Lighting battery boxes are placed over the aisle



The enclosed porter's berth at one end of the car is accessible from the transverse corridor opposite the end door

floor without disturbing the sleeping passengers. The illumination, thus made available, will permit the occupants of the cars to read, write letters and play cards.

Kitchen Cars Also Being Built

In addition to the troop sleepers, 400 new kitchen cars are under construction and will also be government owned, and operated and maintained by The Pullman Company as part of its "pool," except for the food service which will be army rations handled by regular army mess crews.

Plastics for the Railroads

(*Continued from page 455*)

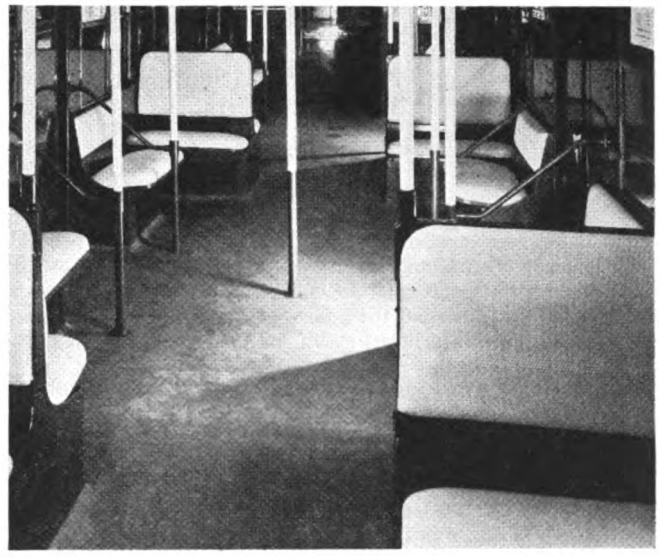
bar. In addition, the flexural qualities are good as are the electrical properties. The moisture absorption rate varies according to the base used but, generally, is quite low. Color possibilities in this type of plastic are limited and they can be manufactured, because of the use of a paper, cloth or other base, only as opaque products.

Probable uses for plastic materials on the railroads will be determined, at least in part, by the uses to which they have been adapted in the aeronautical and marine field. These uses will serve only as indicators of the extent to which they can be employed in the mechanical department. Most of the present uses are either decorative or concerned with electrical installations. There appears to be an immediate post-war future for seat coverings, window shades, lighting fixtures, cab and vestibule curtains, molded journal box lids and other molded products. Plastic tubings may prove satisfactory in many car and locomotive uses as electrical conduits or as oil lines. Fittings for these are available. Although these pipes and tubings have proven satisfactory in many applications they have not yet been employed extensively in industries which have service requirements comparable to those of the railroads. Coming from the vinyl chloride acetate resin group they are practically immune from effects of acids or alkalies. They are not recommended for exposure to severe freezing conditions and are recommended only for temperatures which do not exceed 170 deg. F. Within the temperature ranges suggested, they are tough, durable and have good service life. When used as piping, they can be either welded or threaded. Standard pipe threading equipment can be used although certain modifications in tool grinding are necessary. In most cases, the tubing can be flared with standard equipment and the changes in practice required of a workman are readily learned.

The pipe and tubings have good physical characteristics as regards tensile strength, workability and, in the case of tubings, flexural strength. Resistance to impact is low and, as mentioned, the temperature range within which they can be employed is considerably more limited than in the case of metals. They offer an advantage by their almost complete resistance to acids and alkalies.

The molded journal box lid represents only one of the possible uses for molded products, among others being drinking fountains, toilet fixtures, etc. The laminated types offer a wide variety of possible installations in panelling, switch cabinets, freight-car linings or sheathing, temporary floorings, battery casings, etc. Various other types are likely to be found in seats, tables, upholstery and seat coverings.

Test installations of seating fabrics on the New York subways and suburban railroads running out from New York indicate that the future for seat coverings made of saran, which is a vinylidene chloride resin, is likely to be of great interest to men in the passenger car field who are interested in long service life and easy cleaning.



Courtesy Firestone Industrial Products Co.

A New York subway car with seats of saran rattan which has given several years of satisfactory service—Improved materials of fine fabric strength and in a varitety of colors and weaves will be available after the war

Increased use of plastics can be expected insofar as they are able to meet the technical requirements of the mechanical engineers.

Coupler and Draft Gear Report

A. A. R. Mechanical Division committee makes suggestions for improvement in the design and use of these two important details of car equipment

DURING the year on account of the increased movement of tank cars, many having been taken out of long storage, it was observed that a number of cars were being shopped on account of failures encountered due to coupler operating mechanisms and draft attachments requiring attention. It became necessary to issue instructions to the tank-car owners and handling lines covering the inspection and maintenance of these parts when the cars were on the shop tracks for any other attention.

On September 28, 1942, A. A. R. Circular GC-1062 was distributed to the members and tank-car owners as a guide in connection with the maintenance of this class of equipment. A report of the tests upon which this circular was based is included in Appendix A.

Failure of coupler butts and yokes in service due to cracks, resulting in couplers pulling out, is one of the most serious causes of train partings. The circular Exhibit A directs attention to these critical cracks and methods of detecting them.

Appendix A—Parting of Couplers on Tank Cars

In June, 1942, the attention of your committee was called to an excessive number of train partings in which tank cars were principally involved.

A prompt investigation was undertaken which led to a series of tests on the New York Central.

Within four days after completion of these tests arrangements were made for a joint meeting of all member roads and tank car owners which was held in Chicago on August 12 to consider the results of these tests and take appropriate action. In the meantime the test data had been analyzed and the following conclusions had been reached by the test observers:

"It is fairly clear that the principal factors contributing to the parting of the tank cars are:

a—Loaded tank cars bounce more violently than loaded box or hopper cars or any other type of freight car observed.

b—It has been observed that coupler locks actually do lift when this bouncing occurs and certain other conditions are present.

c—To permit the coupler to open, however, the car must not only bounce violently but the pulling tension on the coupler must be relieved. This accounts for the fact that most partings on the New York Central are reported to occur at or near the bottom of a descending grade, as at Conneaut, Dunkirk, Churchville and Belle Isle.

d—The critical speed for bouncing is between 40 and 55 miles per hour, varying apparently with the ratio of load to spring capacity, track conditions, etc. On Track 2 (eastbound high speed passenger track) the most violent bouncing occurs at speeds between 50 and 55 miles per hour.

e—The condition of coupler operating levers and attachments is a contributory cause of parting. Many of these attachments on tank cars are crude "home made" variations of different standard designs, which irregularities facilitate the lifting of coupler locks when bouncing occurs.

f—Excessive draft gear slack is objectionable, but few of the tank cars observed possessed this defect."

The Chicago meeting on August 12 was attended by 48 persons, representing 16 of the leading railroads and 11 of the principal tank car owners, the latter representing an ownership of 91,087 tank cars. At this meeting it was unanimously voted:

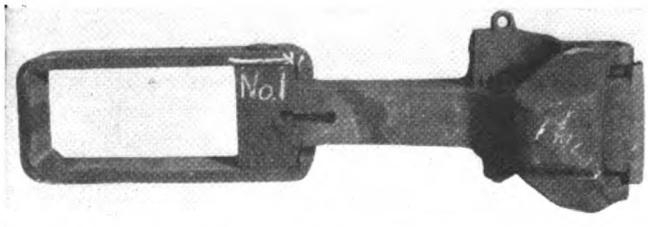
1—That spring snubbers should be applied to all tank cars as rapidly as they can be obtained, these snubbers to be applied both by the railroads and the car owners. When railroads apply the snubbers they are to be billed against the car owner at A. A. R. prices.



Cast steel yoke with a typical failure crack at the front end of the key slot

2—That a circular of instructions be issued to railroads and car owners requiring that tank cars be inspected and conditioned before loading so that they may be reasonably expected to go through to destination without the necessity of intermediate shopping and repairs; also that similar attention should be given to cars when made empty at destination. Definite steps to be taken by tank car owners to provide facilities and labor required to make these inspections and repairs or to arrange for this to be done by some railroad. Especial attention is to be given to the correction of irregularities in couplers, uncoupling mechanism, draft gears and attachments.

A subcommittee, consisting of representatives of the Pennsylvania, Southern Pacific, Missouri Pacific, New York Central and four leading tank car owners, was appointed to draft specific programs to carry out the above



A wrought yoke with a hairline crack in the top lug



Cast steel yoke with a crack in the bottom corner of the housing

decisions. This subcommittee met next day, and agreed upon programs which were subsequently approved by the A. A. R. and the tank car owners.

All tank car owners were requested to submit monthly reports of progress made in the application of snubbers. An analysis of the latest summary of these reports, covering status as of February 1, 1943, reveals wide difference in the degrees of diligence exercised by the various tank car owners in carrying out the recommendations to apply snubbers to all of their cars. The results may be summarized as follows:

1—40 owners, representing a total of 2,803 cars, report 100 per cent of cars equipped.

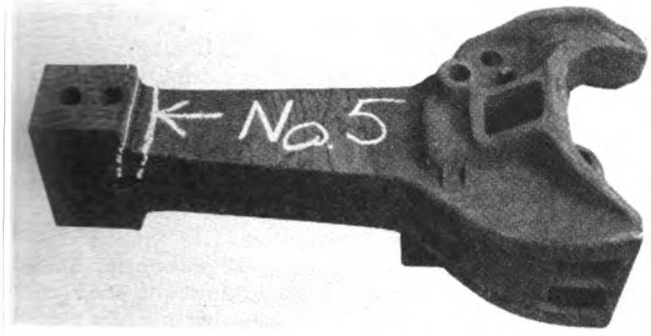
2—All owners reporting, representing a total of 139,381 cars, report an aggregate average of 28 per cent of cars equipped.

3—One large tank car owner, representing an ownership of 38,706 cars, reports 49 per cent, or nearly half of these cars equipped to date. At this rate this owner will have all cars equipped before August 1 of this year.

4—Another large tank car owner, representing an ownership of 27,755 cars, reports only 3.7 per cent of these cars equipped. At this rate this owner will require more than ten years to equip all cars.

5—40 owners, representing a total of 1,015 cars, who have withheld the granting of authority to equip their cars with snubbers but have stated that they have made their own arrangements to have this done, show no cars equipped to date.

6—42 owners, representing a total of 2,346 cars, report no program for equipping cars nor for having them equipped.



A coupler cracked at the juncture of the shank and butt

Exhibit A—Proposed Circular to Members and Tank-Car Owners—Inspection of Couplers for Cracks

A circular, dated January 21, 1943, called attention to certain specific items in connection with the inspection and maintenance of tank cars that should be given particular attention. It also directed attention to a number of other conditions that should not be overlooked when cars are available on the shop track for such inspection and attention.

The type of defect that is likely to result in a train separation, possibly derailment, if not detected and the coupler renewed, is shown on the attached four photographs of riveted yoke and vertical key type couplers removed from tank cars.

With the riveted yoke type, careful inspection with a spotlight should disclose any crack along the side of the coupler shank below the key slot and cracks occurring across the bottom surface of the coupler shank should be detected unless obstructed from view by the end of the coupler yoke. On couplers applied with vertical cast steel yokes, the butt section cannot be inspected unless there is occasion for removing the coupler.

While inspecting the coupler shank for cracks, attention should also be given to the condition of riveted yokes. A crack in the bend of the yoke where it is formed over the butt of the coupler indicates the rivets are loose and are worn or partially sheared; this or any other condition indicating broken or loose rivets warrants the renewal of the yoke, rivets or both. When opportunity permits, thorough inspection should be made of the back end of vertical strap yokes.

Special attention should also be given to the condition of excessive slack in draft gears and attachments as well as coupler height and excessive vertical clearance in the striker casting, either one or a combination of which may contribute to couplers overriding.

At a time like the present, when so much depends upon uninterrupted movement of tank cars carrying petroleum products, too much emphasis cannot be placed upon the importance of close inspection and maintenance of couplers and yokes.

Trains Parting Due to Toggles Inverted or Missing

In the report of this committee, for 1940, the question of train partings of cars equipped with rotary bottom-operated standard Type E couplers, due to inverted or missing toggles, was fully discussed. The report stated that your committee on February 19, 1940, had approved the redesign of the rotary lock lift and toggle assembled into one unit, secured by a rivet, to replace the two-part rotary lock-lift lever and toggle.

In the annual report for 1941, on account of additional trouble being experienced from partings due to inverted or missing rotary lock-lift toggles, your committee concurred in the recommendation of the Arbitration Committee that provision be made in the interchange rules permitting the repairing line to renew the old-style rotary lock lifter or toggle, if defective, and replacing it with suitable parts in kind or with the two parts riveted together. It was also decided to discontinue the manufacture of the old-style two-piece lifter and toggle.

A considerable number of cases of partings, knuckles coming open, have recently been experienced on account of the old-style Type E separate toggles being inverted or missing and D toggles being substituted for E toggles, in all cases destroying the anti-creep feature. In the opinon of your committee, this trouble is sufficiently serious for prompt and decisive action to eliminate the cause.

It is apparent that the action heretofore taken permitting roads voluntarily to substitute the riveted type of rotary lift lever and toggle to replace the separate rotary lift lever and toggle in repairs when cars are on the shop tracks, is not bringing about replacement of these separate toggles in the Type E coupler which have been causing trouble. The following action is, therefore, recommended:

A—All roads and individual car owners should be required to replace the separate rotary lock lift and toggle, irrespective of their condition, with the assembled unit riveted together on Type E couplers when such cars are on shop tracks.

B—Make provision in the interchange rules, that after January 1, 1945, no cars will be received in interchange equipped with the bottom rotary operated Type E couplers having separate lock-lift levers and toggles.

C—In order to bring about an immediate improvement, pending the application of the riveted assembly rotary lock lift and toggle, it is recommended that the

enclosed circular, Exhibit B, be issued to all railroads and private car lines. It shows cause for knuckles coming open in trains where the anti-creep arrangement is destroyed on either the D or E couplers due to improper application of separate toggles or missing toggles from the Type E coupler. If properly followed, it should prevent partings due to knuckles opening from improperly applied or missing toggles. (Exhibit B is not included in this abstract of the committee's report on account of space limitations.—Editor).

Yield Strength of Standard E Knuckles

Reports have been made of Type E knuckles failing in service. This matter has been handled with the coupler manufacturers' Mechanical Committee to see if the yield strength of the knuckle can be increased sufficiently to relieve partly the knuckle failure and at the same time not increase the strength of the knuckle to the point where the bar is likely to fail. Your committee is actively pursuing this matter, but at the present time can only report progress on the development.

The coupler manufacturers' Mechanical Committee reports difficulty encountered in securing suitable tubing for bushing coupler shanks, pockets and yokes where bushings are required.

Your committee well appreciates the situation with regard to obtaining certain tubings and an effort is being made through the channels of the association that may be helpful to the coupler manufacturers in securing suitable priority rating from the WPB to obtain these bushing materials. In the event the coupler manufacturers cannot furnish the bushings, it is recommended that they so advise the purchaser, requesting an expression as to whether the couplers should be furnished bored for the bushing so the purchaser can supply the bushings or whether the coupler be furnished drilled to the proper diameter to receive the pin without the bushing.

Tight-Lock Couplers

Your committee, in joint session with the Mechanical Committee of the coupler manufacturers, held in Cleveland on February 2, 1943, reviewed further improvements to the new design tight-lock coupler and also improvements that may be applied to existing tight-lock couplers. The details of these improvements were covered in a special report, February 4, 1943, to the General Committee for consideration at its meeting held in Chicago, February 10, 1943, and the various items covered by this report were approved.

The new design tight-lock coupler will be identified as A. A. R. Type H tight-lock coupler and the modified existing tight-lock couplers will be changed for rotary operation and the same principle of anti-creep arrangement incorporated as provided in the new Type H coupler.

A new design coupler operating mechanism, identified as A. A. R. Type 6, was also included in this special report. This type operating mechanism will be used to operate either A. A. R. Type H tight-lock couplers or the modified existing tight-lock coupler when changed for rotary operation. When existing tight-lock couplers are modified for rotary operation and Type 6 operating mechanism is applied, the Type H tight-lock coupler may be substituted in replacement of the existing coupler without any change to the operating mechanism. The modifications to existing tight-lock couplers to provide improved anti-creep arrangement and rotary operation are optional with the car owners.

The Mechanical Committee of the coupler manufacturers have prepared Circular No. 942-A, which covers in detail the procedure for modifying existing tight-lock couplers to include the improved anti-creep arrangement, rotary operation and Type 6 operating mechanism. This circular shows in detail the changes required in the various coupler parts and the gages necessary to make these improvements properly. This circular has been approved for printing and distribution by the Mechanical Committee of the coupler manufacturers, to the railroads wishing to modify existing tight-lock couplers. The coupler manufacturers are in a position to furnish the necessary gages and engineering assistance to make these improvements.

Your committee requests the approval of the General Committee of the action taken rather than handling it by the issuance of a circular by the Mechanical division, inasmuch as the roads having tight-lock couplers in service have been kept informed as to the progress of the work and due to the Mechanical Committee of the coupler manufacturers following up in detail the changes being made.

Limitations on Welding Couplers and Cast Steel Coupler Yokes

In an effort to conserve material to the utmost during the war emergency, your committee in March, 1942, appointed a subcommittee to conduct tests of couplers and yokes that had been welded by the electric process, to determine the extent to which welding could be safely permitted.

With the co-operation of the Erie, Pennsylvania and New York Central, also the Mechanical Committee of the coupler manufacturers, these tests were completed. The recommendations submitted were subsequently approved, with some modifications, by this committee and the Committee on Car Construction and then incorporated in the interchange rules.

Later, the original subcommittee was enlarged and instructed to conduct similar tests on specimens welded by the oxyacetylene process to ascertain if the emergency provisions already approved for these parts when welded by the electric process could be extended with safety to include the oxyacetylene process.

These latter tests are now in progress and a report of all the activities of this subcommittee, including proposed tests of welded side frames, will be presented in a subsequent report.

Welding Metal Shims on Butts of Couplers

Several railroads have stated that they have an accumulation of 5-in. by 7-in. 6½-in. butt couplers for which they have only a limited use, but are badly in need of 5-in. by 7-in. 9⅛-in. butt couplers. Permission is requested to weld metal plates to the side of the butt of the 6½-in. couplers to bring them up to 9⅛-in. size.

The subcommittee on Welding of Couplers and Cast Steel Yokes has been instructed to conduct tests and submit recommendations. It has been decided that dynamic tests are necessary and tests of standard 9⅛-in. butt couplers will be used as a basis for comparison. Arrangements have been made to obtain the necessary specimens from the Pennsylvania and the tests will be made within the next few weeks under the 27,000-lb. drop hammer in the Association laboratory at Purdue University.

Report of Subcommittee on Draft Gears

Approved Draft Gears

The number of approved draft gears still stands at twelve which are made by six different manufacturers.

Two of these gears are conditionally approved, and have been so for a period of more than two years, but it has not been thought necessary to take action to change this status because few, if any, of these two types of gears have been sold. The chief purpose of conditional approval is to prevent too extensive use of gears having a background which consists of nothing but performance in laboratory tests.

The Cardwell Type L-25-SA draft gear will be replaced in the list of approved draft gears by the Cardwell Type M-25 gear. This action finally resulted from the unsatisfactory showing made by the L-25-SA gear in the 1938 check tests. In these check tests the L-25-SA gears were found to be deficient in release action and also they failed to meet fully the minimum capacity requirements for new draft gears. In order to overcome these defects the manufacturer changed the interior design of the gear. The exterior appearance remains similar to that of the L-25-SA gear, but at the suggestion of the committee the housing for the M-25 gear has been constructed so that only the correct interior parts can be used. Since the L-25-SA gear is being replaced because it was found unsatisfactory, it is recommended that this gear be placed in the non-approved classification. Its price will be protected in interchange repairs, but it will not enjoy the benefits of permissible substitution for approved draft gears.

The Peerless Type H-1 gear has been superseded by the Peerless Type H-1B. This action likewise resulted from the unsatisfactory showing which the Type H-1 gear made in the 1938 check tests. In these check tests this gear was found to be seriously deficient in capacity. The manufacturer has made no substantial change in the design of the original gear but has established a new working-in practice which is expected to produce gears in the future that will fully meet A. A. R. requirements.

The Westinghouse Types NY-11-E and NZ-11-E draft gears have been superseded by the Types NY-11-F and NZ-11-F, respectively. In both of these cases the changes were made on the initiative of the manufacturer and consisted of slight improvements in the design of housings, which are not expected to have any effect, either favorable or unfavorable, on the action of the gear.

Laboratory tests have been made of Waugh-Clark Type 150-B draft gears, conditionally approved, embodying several modifications in construction proposed by the manufacturer. These laboratory tests are being supplemented by service tests on engine tenders on the road of one of the committee members.

As required by the regulations in the appendix to the draft gear specifications, the manufacturers of approved draft gears have been canvassed by the secretary of the Mechanical Division in order to find out if the records of approved draft gears are up to date. In this connection, as soon as a manufacturer has complied with all of the additional requirements added to the draft gear specifications by the 1941 revision he has been notified to change the marking on his approved gears to "AAR-1941". The last previous issue of the draft gear specifications was dated 1937 and all approved draft gears made since have been marked "AAR-1937".

The 1941 revision of the draft gear specifications added three requirements:—First, that the surfaces on which the gear closes shall be reasonably parallel, and perpendicular to the axis of the gear; second, that all gears in the condition as received from the manufacturer shall have a minimum capacity of 15,000 ft. lb., determined in as few as possible drops of the 27,000 lb. tup; and third, that each manufacturer must file a statement of the working-in process used during the assembly of his gear. The committee has taken steps to see that each manufacturer complies with these additional requirements, and will not permit any gear to be marked "AAR-1941" unless it meets them.

The question has been raised by one of the Canadian member roads as to what assurance can be given that all certified gears manufactured in Canada fully comply with A. A. R. requirements. Reply has been made that specific information is not available, but the facts will be ascertained as soon as possible. A. A. R. requirements are of course the same, whether gears are manufactured in Canada or in the United States.

Check Tests of Certified Draft Gears From Service

The committee has made a third check test of approved draft gears, which has been designated as the "1941 Check of Certified Draft Gears From Service". Check tests were previously made in 1938 and 1940, the gears in both of those tests being new gears secured in 1938 from railroad stock and in 1940 from manufacturer's stock. The gears in the 1941 check test were ones that had been in service for five years on 50-ton hopper cars.

The data secured in the 1941 check test confirmed the action taken as a result of the information secured in the previous check tests, and also furnished information to indicate that the whole program of certifying draft gears is having beneficial effects. Thirty-four draft gears of nine different types were inspected and tested on this program. In nearly all cases both gears and draft attachments were found in remarkably good condition.

Full details of this 1941 check test are given in Appendix B of this report (not included in the present abstract of the committee's report on account of space limitations.—Editor).

Tests of Waugh-Mat Draft Gear for Freight Service

The Waugh Equipment Company has under development a rubber draft gear for freight service which is designed to go in the standard draft gear pocket. The committee had conducted extensive tests of this gear before the present emergency arose, which has served to curtail this development. These tests included complete specification tests under the 27,000-lb. drop hammer and extensive tests on the car impact plant. Based on the information secured in these tests permission was granted for the installation of 1,400 car sets of this gear, but these installations have never been completed because of the curtailment of the use of rubber. Present reports indicated that 232 car sets have been installed. In addition to the tests conducted on these gears, the committee has secured installation data and measurements on seven car sets of gears, this to be used for future checks of their performance in service. One gear is also being held in the laboratory under continuous assembly compression, and each month a capacity test is being made on this gear to determine how it stands up. This has been continued for about a year now, and so far the gear has not lost any capacity.

(The report was signed by Chairman R. L. Kleine, assistant chief of motive power (car), Pennsylvania; vice-chairman H. W. Coddington, research and test engineer, Norfolk & Western; F. T. James, chief of motive power, Delaware, Lackawanna & Western; L. P. Michael, chief mechanical engineer, Chicago & North Western; W. Bohnstengel, engineer of tests, Atchison, Topeka & Santa Fe; H. W. Faus, engineer of motive power, New York Central. The subcommittee on draft gears included Messrs. Faus, Coddington and Bohnstengel, Mr. Faus serving as chairman. L. H. Schlatter, test department, Pennsylvania, was a member of the subcommittee.

Reading

Fuel Instruction Car

Models and operating diagrams of many appliances provide for the education both of enginemen and firemen in other phases of locomotive operation

THE Reading has recently installed a fuel instruction car which is now on its first tour of the road. This car is a steel-underframe coach which has been refitted with models and operating diagrams of most of the important pieces of apparatus installed on a locomotive. The car is primarily intended as an aid in the education of new men who are being taken into the engine service. Major emphasis is placed on firing practice and the operation of boiler feedwater equipment, although the car provides instruction material for dealing with practically, all aspects of the handling of a locomotive, with the exception of the air-brake system for which there is a separate instruction car. The fuel-instruction car is thus of almost equal service to the older enginemen as well as to the new firemen.

The car began its service in July on the Shamokin division. It was on the Reading division during August and will be run successively over the L. & S. division, the Philadelphia division, and the Central Railroad of New Jersey.

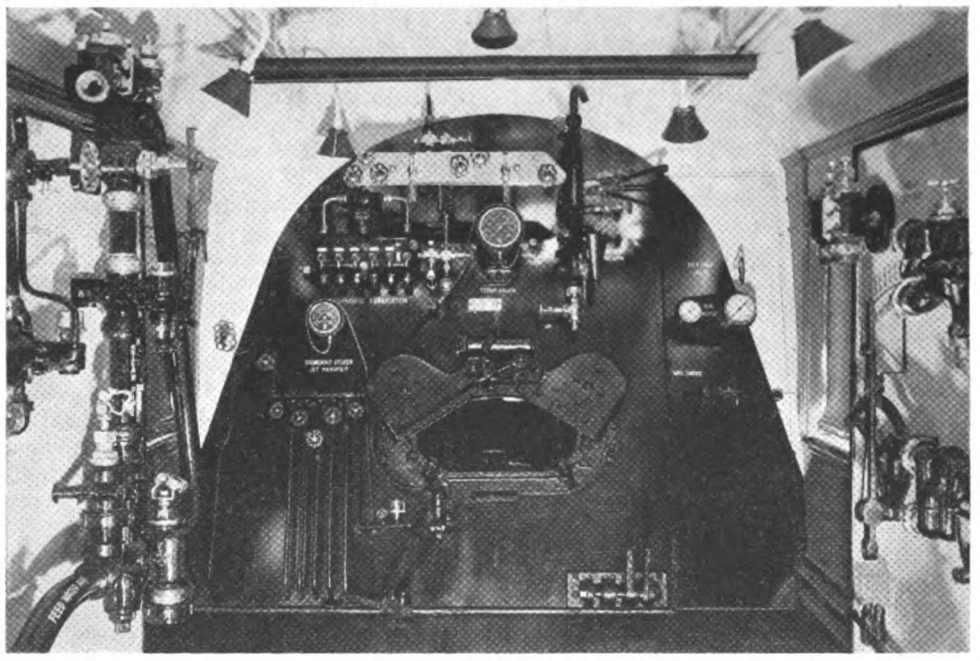
The Equipment on the Car

Across one end of the car is a full-scale dummy boiler back head on which have been placed the railroad's standard back-head mountings. These are all clearly labeled. They include the turret-valve board, water glasses, water column and gauge cocks, steam and air gauges, hydrostatic lubricator, sander valve, pneumatic fire door, the stoker gauge and the stoker manifold, and control valves. Behind the fire door is located a stoker fire pot. This is piped for operation by compressed air so that the effect of the manipulation of the control valves can be observed by the movement of streamers which are attached at the outlets of the firing nozzles.

A crown-sheet plug in the back head marks the horizontal projection of the highest point of the crown sheet where it can be compared with the bottom of the water glass and the bottom gauge cock. In a table at one side of the back head are set forth the standard differences in elevation between the crown sheet and the bottom gauge cock of all the locomotive classes on the Reading system.

Near the opposite end of the car an operating scale model of a Duplex stoker, including the boiler back head and cutaway top and sides of the firebox, is mounted on the floor. This model is also piped for operation by compressed air.

Opposite each other, against the sides of the car, are two large display boards. On one of these is a complete non-lifting injector, including the water connections to the tender and the tank valve, and a top-mounted double boiler check with stop valves. Other devices displayed on this board are a tender water-scoop valve and operating cylinder, steam-operated cylinder cocks, pneumatic sander equipment, and boiler blow-off cocks. The water-scoop equipment, the sander



A complete set of standard mountings are displayed on a dummy boiler head across one end of the car—Stoker manifold and fire door are operated by compressed air

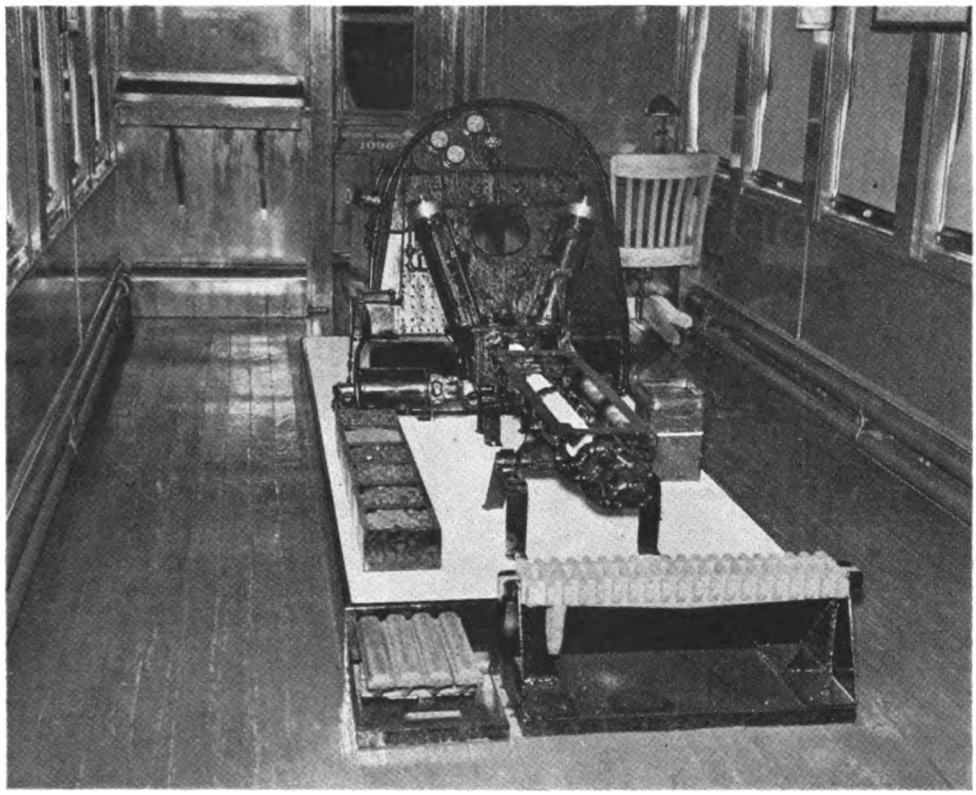
and the cylinder cock are piped for operation by compressed air. On the panel across the car are mounted models of the several types of injectors in service on the Reading or Central of New Jersey locomotives, a double boiler check and a hydrostatic lubricator model. A dummy reverse lever on this panel has a scale graduated in per cent cut-off for each notch in the quadrant from the center to the forward corner.

Other devices and parts are displayed on shelves at slightly below window-sill height. These include several models of force-feed lubricators, a steam-heat regulating valve, double-seat gauge cocks, and various details of other appliances such as injector combining tubes, and parts of boiler check valves and blow-off cocks. There is a complete operating model of a speed recorder. There are scale models of a grease-lubricated driving box and of the types of front ends on Reading locomotives.

A small hand-operated model of a Walschaerts valve gear is arranged so that the effect of the various reverse-lever positions on the movement of the valve can be observed.

Some of the cutaway models are accompanied by operating diagrams in color. A number of such diagrams are also provided for other locomotive appliances for which there are no models. These include the superheater, the feedwater heater, and the exhaust-steam injector, and a boiler low-water alarm. Other material are available in the form of manufacturers' instruction sheets and booklets on the power reverse gear, feedwater heater, stokers, soot blowers, injectors, and flexible pipe joints. The diagrams and instruction sheets are displayed in frames about the walls of the car and the booklets are arranged upon a small table at one side of the car.

At the entrance end of the car are wardrobe and closet space. Against the inside end wall is an instructor's desk on one side and a desk for registration on the other. The car is not equipped for occupancy en route. Electric power for lighting and for operating the record player and projector is plugged in from an outside source, and compressed air is provided in the same way.



A scale model of the Duplex stoker—Grate bars and samples of coal mixtures used on the road are also included in this display

On Lecture Tour

On the present tour the car will visit all of the terminals of the system at which enginemen and firemen can be reached.

The program at each point provides regular class periods, including formal lectures, as well as informal discussions, time for questions and answers, and for the study and operation of the models by the men themselves. About one hour is required for the formal program. The lectures for this part of the program have been recorded and are delivered from double-face records by a phonograph with magnetic pick-up which forms part of the regular equipment of the car. It has a recording attachment.

The first lecture deals generally with locomotive operation, stressing the importance of economy in the use of fuel, and of safe practices, and emphasizing the need for the development of good judgment. This is followed by another short recorded lecture accompanied by slides, for which a projector and roller-type screen are provided. The screen is permanently installed just in front of the large boiler-head model at the end of the car. This lecture deals entirely with firing practice and is illustrated with a series of 18 colored slides. In the preparation of both of these lectures primary consideration has been given to the interests of the new men.

Following these two lectures the instructor in charge of the car calls attention to some of the more important devices on display, usually stressing some point per-

taining to their operation or methods of dealing with possible failures on the road with which experience has demonstrated that many enginemen are unfamiliar. This leads into a period of informal questions and answers on the part of some of the men, a few of whom may spend another hour or more if their own time and the schedule of classes permit.

During a general tour, such as the car is at present making, it spends from one to four or five days at a terminal, depending upon the number of enginemen employed. Attendance is not compulsory, and no special effort is made to get men to visit the car when reporting for duty or at the ends of their runs.

Experience so far indicates that better results are obtained by notifying men who are not on duty that the car is in town, where it is located, and the schedule of classes. Then the men who report at the car can spend the time for a regular class and additional time for studying the exhibits in which they are particularly interested. All men in attendance are requested to register. The most desirable class size is from 12 to 18 men.

While the equipment and instruction program are primarily intended to meet the needs of enginemen, shopmen are welcomed and encouraged to visit the car whenever they have an opportunity to do so. The instructors are prepared to call their attention to helpful information concerning some of the devices which will be of assistance in dismantling them or diagnosing troubles encountered with them. This is particularly useful in cases of equipment with which some of the men are only occasionally called upon to deal.

The Program Still Developing

With the completion of the current general instruction tour, it is proposed to use the car for a special instruction campaign to deal with the problem of tank heating during severe winter weather. The methods of operating tank heaters differ with various types of injectors in use on the Reading and Central of New Jersey locomotives. The result is that considerable confusion has developed in the minds of some of the men on whom dependence has to be placed to keep locomotives from freezing up.

Based on the attendance at the various points at which the new car has been stationed since it went into service, it is believed to have fully justified itself. Expressions of interest and approval on the part of the men who have attended the classes have been highly gratifying. At the present time preparations are being made for one further step which it is believed will increase the effectiveness of the time so spent by the men. This step is being taken in the belief that few men can listen to a speaker and retain clear impressions of more than a small part of what he has to say. A series of brief instruction sheets or pamphlets are being prepared for distribution to those who visit the car. Each of these will present the fundamental principles of operation of the various types of equipment involved in locomotive operation. It is the belief that supplementing the interest aroused by the lectures and the opportunity to study the working details of locomotive appliances with simple printed material which can be taken away from the car will add materially to the effectiveness of each.



Mechanical lubricators and front-end and driving-box models are displayed along this side of the car

EDITORIALS

Six Questions for Roundtable Discussion

The November issue of the *Railway Mechanical Engineer* will be devoted to "Conventions in Print" of the so-called Coordinated Mechanical Associations—the Railway Fuel and Traveling Engineers' Association, the Car Department Officers' Association, the Master Boilermakers' Association, and the Locomotive Maintenance Officers' Association. During the years preceding Pearl Harbor, these associations met each Autumn at one time and one place.

Last year these meetings were considered inadvisable. Each one of the four associations, however, had organized its committees and had laid out its year's work before the question of whether or not to hold its meeting had been finally decided. Each, therefore, went ahead with its year's work and completed its committee reports. These were printed in our November issue much as they would have been had the annual meetings of the associations been held, with the exception, of course, that there were no discussions. The reports were then published by the associations in their customary year books.

This year, even though there was no hope of holding their annual meetings, the Railway Fuel and Traveling Engineers' Association, the Master Boiler Makers' Association, and the Car Department Officers' Association organized committees which have proceeded with the preparation of their reports and these reports will again form the basis of "Conventions in Print" in our November issue.

The Locomotive Maintenance Officers' Association, in lieu of reports prepared by organized committees of the association, is sponsoring the Roundtable discussion in that issue. This discussion will deal with six questions; each pertains to a matter of direct interest to officers and supervisors having to do with locomotive maintenance. The questions are as follows:

1—Have you employed special training methods for supervisors and mechanics? What results have you obtained from these wartime measures? What features of this training do you think are suitable for your post-war training program?

2—Has any improvement been made in reducing the turning time of locomotives in your terminal in recent years? What facilities or methods have been responsible for this improvement?

3—What particular problems are giving you concern in the servicing and maintenance of Diesel locomotives? Have you found it necessary to provide special facilities and organization other than those required for steam locomotives? What?

4—Have you used flame hardening on locomotive parts? Has this process helped to solve material shortage problems?

5—What new applications of welding and cutting have you developed to meet the lack of materials and replacement parts? For instance, on driving boxes, crossheads, brackets, and to replace various small forgings and castings?

6—Which is better—boring, grinding or honing—such parts as air-brake pumps, feedwater-heater-pump cylinders, reverse-gear cylinders, etc.? Why?

Do you have pertinent information or experience related to any of these subjects which might be helpful to your contemporaries on other railroads? If so, write us a letter presenting your views or experience. Make it short and directly to the point. It should reach New York not later than October 15.

Grounded Wiring Systems For Diesel-Electric Locomotives

A one-wire system of electric wiring for steam locomotives is being used by the Norfolk & Western. This kind of wiring is essentially similar to that used on an automobile. A single wire carries the circuit through the switch to the headlight, the return being made through the metal of the locomotive. Similar one-wire circuits supply the other lights. The manner in which it is being done, with necessary modifications for the transition stage from a two- to a one-wire system, is described in the Electrical Section of this issue.

The simplified wiring will be applied to new locomotives being built and to existing locomotives that need rewiring. Since the I. C. C. requires an insulation resistance of one megohm on locomotives having cab signals, it will not be applied to locomotives so equipped.

The advantages of such a system are the simplification of the wiring and the saving of critical materials, namely, rubber and copper. With a two-wire system, it is possible to have a ground on one side without causing a failure, but it may also be argued that since there is only half as much wire, there is only half as much chance of a ground. Actually, grounds outside of junction boxes are usually caused by damage or deterioration, and either system is equally vulnerable to these causes. Aside from the saving of material and the advantage of simplicity, the one-wire system has proved to have a practical operating advantage of reliability. With a two-wire, non-grounded system, it is possible for a single ground to exist for a long time until a ground occurs on the opposite polarity. This makes two cases of trouble to run down and fix, whereas with the grounded system, wiring trouble will show up immediately when defects occur.

The practice of using a one-wire system is applied extensively to power circuits on electric locomotives. It is used on the 3,000-volt d. c. locomotives of the Chicago, Milwaukee, St. Paul & Pacific; on the 3,000-volt d. c. multiple-unit cars of the Delaware, Lackawanna & Western; on the 1,500-volt d. c. multiple-unit cars of the Illinois Central; on both 600-volt cars and locomotives of the Long Island on many suburban and subway cars, etc.

Some Diesel-electric locomotives have two-wire ungrounded wiring systems, others have two-wire grounded systems, while still others have single-wire power circuits with frame or ground return. There seems to be quite general agreement that two-wire ungrounded systems be used for control wiring, but there is no uniformity of practice for the power wiring.

The Land Transportation Committee of the American Institute of Electrical Engineers is at present studying this subject. There are many Diesel-electric locomotives being built and a general agreement on wiring practices would stop the extension of a chaotic condition. Expressions of opinion would help the work of the Committee. If there are those who feel that a single-wire power wiring system is inadequate or who can make other suggestions based on experience, they are offered the facility of these columns to explain their position.

Oil and Keep Machines Clean

The familiar instructions "Oil and Keep Machines Clean" were never more important to follow than at present. Possibly the order should be reversed, as no machine can be satisfactorily oiled until exposed bearing surfaces are first cleaned. The condition of shop machinery and tools, as noted by even a cursory examination, tells critical observers more than might be expected about the capacity of the machine operators and, in fact, the shop management itself. There may be some instances in which men, more or less careless about personal appearance and the cleanliness and good order of their machines and surroundings, do fairly satisfactory work, but, in general, the habit of mind which tolerates the use of dirty tools indicates a carelessness which is more than likely to be reflected in the products of those tools. Progressive shop managements realize that even old machine tools can and should be kept clean, but when it is possible to replace old tools with new up-to-date models, a powerful incentive is thereby given to operators to take proper care of these fine modern machines with which they earn a livelihood.

A number of machine-tool manufacturers have gone to the expense of issuing booklets explaining in detail the best methods of cleaning and lubricating their individual types of machines and, in general, these instructions should be closely followed. They point out that grit, scale and fine chips, if not brushed away, tend to mix with oil and form an abrasive sludge which increases friction and wear of V-ways, dovetails and other machine bearing surfaces.

The necessity of providing machine operators with suitable hand brushes and clean wiping cloths is apparent and, in this connection, air jets must be used with great caution, if at all, in removing dirt and small chips to avoid blowing this material into bearings and other inaccessible parts of machines where it will cause damage. The use of soft cord to clean lead screw threads, bent wire with V-shape ends to clean faceplate interior threads, bottle brushes for taper holes and various types of guards to catch the dust from tool-post grinders are excellent suggestions in one of the booklets now being distributed to machine users. The importance of adequate means for chip disposal, both on and around machine tools, is also stressed. Obviously, any time, within reason, spent to keep machine tools clean is a good investment in view of the increased machine life, higher production and greater ease of operation which result.

The same general statement can of course be made with respect to lubricating shop machinery. The primary purpose of lubrication is to minimize friction and extend service life by providing a film of oil which prevents metal-to-metal contact of the bearing surfaces. The use of correct grades of oil, as specified by the manufacturers, keeping all oil passages clear and well covered when necessary and developing in machine operators adequate and thorough oiling *habits* will be found most helpful by shop supervisors who take the trouble to look after such details.

Will We Use Plastics?

Elsewhere in this issue appears an article which is a general survey of the new field of plastics. Both as to chemical antecedents and physical properties, the field is broad and widely varied. While not all of the information concerning some of these materials needed to determine the full range of their possible usefulness is available, for many the information is fairly complete. An exhaustive treatment of the properties of all of these materials, many of which may be of relatively little interest on the railroads, has not been attempted. The article presents a general picture of the scope of the field and suggests sources of detail information. It will be evident to all who read the article that this is another field with which those concerned with design and construction must become familiar. Plastics offer many advantages as structural, electrical and decorative materials.

Metallurgy has long been a field in which designers and builders were at home; the study of plastic products and their qualities must now be added. It probably

will not be necessary for any of us to qualify as chemical engineers in order to understand what can be done with plastics; it will be necessary, however, to regard them as the new materials which they are. Plastics have many properties which cannot be compared readily to any of the materials which are more commonly known in the railway field. In any event, they should not be looked upon as substitute materials. Some can properly be termed alternates, others must be given consideration as entirely new, having properties and qualities which entitle them to a place in anyone's list of available materials. They are not substitutes.

It has been interesting to learn, through our Roundtable and by contact with plastic manufacturers, that both the railroads and the manufacturers are waiting for the other side to say what is needed. Certain of the manufacturers are aware of the prospective railroad market but do not know just how to approach the field; with few exceptions the railroads have little understanding of what the manufacturers can do for them. In the post-war period we can expect that this condition will be corrected to some extent as manufacturers, now busy with war orders, seek new outlets and as railroads seek the best materials for use in the construction of new equipment.

It is probably incorrect to ask whether we will use plastics. For many years some plastic materials have been in extensive use for railroad applications. Many more of them will be available later and some understanding of what they really are and of what they can do will benefit railroad mechanical men. An attempt has been made to indicate their wide range of possibilities; studied acceptance and extension of their adoption on railroads is indicated. We will use them but a large gap in understanding must first be closed between the producers and railroad users.

New Machinery A Long-Time Guarantee

There are indications that the rather indifferent attitude of many railroads toward the replacement and modernization of shop equipment and machine tools used for locomotive and car repairs is finally bearing fruit in the inability of the older tools to deliver the goods under present conditions. Most railroads have not had any major tool replacement programs since the period between 1925 and 1930 with the result that the average age of machines in most shops is considerably beyond 25 years. Even before the war brought on the traffic demands of the past 20 months a 25-year-old machine tool had no place in a shop where accuracy and output are important factors.

In spite of the experience of industry with modern tools and tooling equipment many roads have been reluctant to discard machines which were still serviceable. On the other hand a few roads have been outstanding by their recognition of the capabilities of modern equipment and have profited thereby. Then came the war and with it a demand for motive power and cars beyond that which the railroad industry had ever before been called upon to meet. Immediately the source of new power and cars was practically closed and the competition of the armed services and the defense industries for basic materials and manpower placed a severe handicap on the ability of the shops to make general repairs to equipment. For the same reasons the modern shop equipment that might have eased the situation was almost impossible to secure because of unfavorable priorities. So, during the past 20 months particularly, the few roads which had been foresighted and had had regular programs of shop equipment modernization found themselves in the fortunate position of having a comfortable reserve of shop capacity while many of the other roads were forced to watch obsolete machines and tools waste man-hours at a time when man-hours were becoming increasingly more valuable.

Several months ago there were signs that the machine tool industry would shortly find itself with some excess producing capacity. There were also indications that the experiences of many roads under the pressure of forced operations had made them sufficiently conscious of the potential value of the new tools they did *not* have to create a desire for immediate replacement once the opportunity presented itself. A survey was made by this publication to discover the nature and extent of this pent-up demand for new shop equipment and if our interpretations are correct the railroad industry has, through experience, so thoroughly sold itself to the value of modern tools that programs involving the acquisition of several million dollars worth of new equipment are about to get under way.

The effect of high-speed, heavy-tonnage operation is reflected in the almost universal demand for that type of machinery used in the finishing of running gear parts —wheels, axles, bearings, rods. There was a time when the two-foot rule was looked upon as a measure of accuracy in railroad shop work. That day is gone. The introduction of such precision-built parts as roller bearings and the use of light-weight running gear parts is now seen as a governing factor in the need for machine tools capable of modern accuracy. This requirement plus the need for greater unit output to meet the growing manpower shortage completely overshadow the element of the peacetime requirement of production at low cost. Yet the new equipment, when installed, will assure low cost production of locomotive and car parts now and in the post-war period when competition will be the keenest.

It is to be hoped that the railroads will take advantage of their present opportunity to make known their requirements for shop equipment. There are two excellent reasons why action is desirable: to assure an adequate supply of motive power during the rest of the war period and to guarantee economical shop operations in the post-war period.

Roundtable:

How to Guard Against Low Water

Careful Maintenance Plus Thorough Training of Crew

First, we in the boiler building and repairing departments, must do the best possible job to keep the boiler and all its appurtenances in the best possible condition; keeping the boiler clean, free from scale and free from leaks; keeping gage cocks, water glasses and all water level indicators in first-class condition, equipped with proper lights and so located that the enginemen can, from their usual position in the cab, know just where and how much water they have. Pumps and injectors and feedwater heaters and all valves used in their operation must be maintained in prime condition.

Enginemen should have proper instructions from some official in whom they have confidence as to his knowledge and experience in the building and maintenance of boilers, and who can stress the importance of carrying a proper level of water in the boiler, and train them not to depend entirely on appurtenances that are designed to prevent low water, since these devices are not infallible in all cases and do occasionally become inoperative. Enginemen should be trained to extinguish the fire at once when low water is discovered, because the intense heat of the fire on the uncovered crown sheet softens the steel so rapidly that it can no longer withstand the pressure of the steam and the explosion is the logical result.

Enginemen should remember that after the water in a boiler lowers to the level of the highest part of the crown sheet, its level falls very fast because of the construction of the boiler. Bad water and foaming boilers are a prolific cause of boiler explosions. Proper water treatment and proper washing of boilers will do a lot to prevent explosions from this cause. It is impossible to tell the true level of water in a boiler that is foaming or dirty, because of the erratic action of the water when the engine is working.

The supervisor in charge of training engine crews to guard against and prevent low water, and to take correct measures to prevent an explosion when low water is discovered, should know boiler construction thoroughly and be familiar with all appurtenances used to supply water to the boiler. He should know the effect of heat on steel and approximately the degree of heat developed in the firebox when the boiler is worked to capacity. He can then explain correctly to engine crews the effect of low water on the crown sheet and the short length of time required after water disappears from sight in the water glass to fall below the highest point of the crown sheet. The softening of the sheet from the heat generated in the firebox can only lead to one conclusion—a burned crown sheet or an explosion.—*D. P. Smith, Boiler Foreman, C. B. & Q., West Burlington, Iowa.*

Boilermaker Foreman Gives Views on Boiler Explosions

Locomotive boiler explosions are caused primarily because at the time of the explosion some part of the boiler is too weak to withstand the pressure to which it is subjected. From a boilermaker's viewpoint, the weakness resulting in failure is caused almost entirely by one condition, i. e., low water. The boilermaker, being familiar with the function of every brace, staybolt and rivet entering into the construction of a boiler, knows that normally the structure is amply strong to withstand four or five times the load placed upon it. He also knows the narrow margin between perfectly safe operation and appalling disaster, if for any reason the crown sheet is allowed to become overheated due to low water.

It is evident from conversation with enginemen, shopmen and other railroaders that the causes of boiler explosions, and the reason for the violence resulting from such explosions is not generally known. Various theories as to excessive pressure being built up in the boiler, water flowing back onto a momentarily uncovered firebox sheet, dynamite in the coal, etc., are often advanced after an explosion has taken place. The true explanation is, of course, quite simple when understood.

The flames and hot gases in a locomotive firebox at a temperature of from 1500 deg. to 2500 deg. F. heat the firebox sheets which, while covered by water, remain at about the temperature of the water. This temperature is dependent on the steam pressure in the boiler, and is in the neighborhood of 400 deg. F. If, however, sufficient water is not at all times present to keep the firebox sheets at the proper temperature, the sheets become overheated. Firebox steel when heated becomes slightly stronger until about 500 deg. F. is reached, after which the strength falls off very rapidly until at 1600 deg. F. the steel has lost about 85 per cent of its strength at normal temperatures.

At some stage during this overheating the strength of some part of the boiler, usually the crown sheet, becomes less than that required to withstand the load of steam pressure, and rupture occurs. The force of the resulting explosion is in proportion to the size and suddenness of the rupture, and the temperature and amount of water in the boiler. At the instant the steam is released from the boiler the water in the boiler flashes into steam until a heat balance is effected. This steam, generated so instantaneously, occupies a space vastly greater than that occupied by the water in the boiler—perhaps 1500 or 2000 times as great. The terrific rush of the steam to occupy this greater space often tears the boiler off the locomotive frame and results in the rocket-like behavior of the boiler.

It is felt that not all enginemen are aware of the small amount of time available to them to remedy the situation when, for any reason, water is out of sight in the glass. A modern locomotive boiler contains somewhere in the neighborhood of 6000 gallons, or about 50,000 lb. of water. Normally the lowest reading of the water glass is 4½ inches above the top of crown sheet. At the instant water ceases to be seen in the glass there are approximately 720 gallons, or 6,000 lb., of water available for evaporation in a large boiler before the highest point of the crown is uncovered. The modern locomotive boiler evaporates somewhere near 80,000 lb. of water per hour when working at capacity. The time available for the engine crew to make any move calculated to overcome the difficulty resulting in low water is therefore limited to something like five minutes, more or less, depending upon whether the engine is on level track or a grade, and how hard it is working.

It is not within the boilermaker's province to tell the enginemen what to do in the event that the water supply fails for any reason, but he can attempt to impress upon them the absolute necessity for quick action to prevent the crown sheet from becoming overheated to the point where its strength is unequal to the load imposed upon it by the steam pressure. The railroad with which the writer is connected has for sometime past conducted an educational campaign in writing and by word of mouth, calling the enginemen's attention to the absolute necessity of knowing the water level in the boiler at all times. A typical bulletin, addressed "To Enginemen," follows:

EDUCATIONAL NOTICE No. 215

"Recently there were two locomotive boiler explosions which resulted in the loss of several lives, as well as large property damage.

"The first of these explosions occurred on a freight engine at which time both the engineer and fireman were killed and the brakeman, who was in the brakeman's house on the rear of the tender, was seriously injured. The tonnage of the train consisted of slightly less than 400 tons of the tonnage rating of that particular class of engine at the time of the accident.

"The report by the Interstate Commerce Commission covering this accident shows that for a period of 30 days prior to the

and Prevent Locomotive Failures

accident the water in the boiler of this engine was reported by engineers to be changed 19 times and that during this same period the boiler had been washed 3 times and the water in the boiler changed 19 times. It was not known whether or not the blow-off cocks had been used from the time of departure from the terminal until time of accident. The report further states that nothing else was found during this period which would have any bearing on this accident.

"The second explosion occurred on a passenger engine while standing for several minutes after it had pulled away from the station. This train had gone 16 miles from its terminal when the first stop was made and after moving a short distance it again stopped and the findings of the Interstate Commerce Commission show that the conductor of the train walked up to the engine and inquired of the engineer, who was then on the ground working on the injector, the reason for the stop and was informed by the engineer that they had trouble with the injector and that they had to get some water in the boiler or else wait for another engine. The report also shows that the fireman was walking away from the engine and he told a section laborer that the engine was going to blow up as there was no water in the boiler. However, shortly before the boiler did blow up this same section laborer saw the fireman turn around and walk back toward the engine. The result of this explosion was that both the engineer and fireman were killed and, of course, the locomotive seriously damaged. The Interstate Commerce Commission's report shows that the daily inspection reports for a period of 30 days prior to the accident did not show anything which would have had a bearing on the accident.

"I am calling these two cases to your attention for the particular reason, as Mr. Bjorkholm and myself have stated many times through the medium of these Notices, 'Do not take chances with water in boiler as you are playing with dynamite if you do.' Mr. Bjorkholm has said to you, and I am in perfect agreement, that if you do have trouble maintaining a safe water level in boiler and have to kill the engine to save damage, we will take your part.

"In this connection I might say that all of our non-lifting injectors are equipped with a tell-tale pipe, its purpose being to warn the enginemen in case the injector breaks. It is very important for you to know that this pipe is open. This can be determined by blowing the steam back through the injector and noting steam discharging from the end of tell-tale pipe which is located at boiler head in cab. This is particularly important in freezing weather. In case you find the tell-tale pipe stopped up be sure and report same on Form 602.—R. C. Hempstead, Asst. Supt. Motive Power."

Enginemen should know that playing with low water is playing with dynamite. It is vitally important at all times that safe operating conditions prevail. At a time like the present when both manpower and equipment are irreplaceable, no effort should be spared to insure that everyone charged with the care and operation of locomotive boilers be properly instructed in regard to low water, and what action to take should this unfortunate condition occur.—*Edward H. Heidel, Boiler Foreman, C. M., St. P. & P. Locomotive Shops, Milwaukee, Wis.*

Operating Suggestions

I believe the items listed below will overcome low water in locomotives and eliminate accidents.

Prior to leaving the engine terminal the engineman must fill out a form showing the condition of the firebox; he must know that water glasses and cocks, as well as the water column, are in working condition; he must know that the injectors and the feedwater system are operating and in good condition. The engineman must report any defects to the terminal foreman in charge for correction. If O. K., he, the engineman, must sign the form which holds him responsible. If the locomotive is operated in extensive service a form should be made out by each engineman in charge, and the form turned in by the engineman at the last terminal.

It must be impressed on the mind of the engineman that he must try the gage cocks frequently en route to know the actual amount of water in the boiler and not depend on the water glasses. Regardless whether the fireman or the engineman is operating the injectors or feedwater pump, the proper amount of water should be around two gages. This will insure a safe margin if there is any trouble with injectors or feedwater system ascending or descending grades, thus avoiding any wash ahead or back in the boiler, exposing the sheet or flues. It is a bad practice for the engine crews to give away water to a low point when locomotive is not steaming. This practice can be stopped by the road foreman of engines and traveling firemen when riding locomotives and must be called to the attention of the engine crew.

Care should be used in starting the locomotive to avoid a heavy wide open throttle when the water has been chemically treated; if not, there is a liability of engine working water, raising it in the water glass, but at the same time reducing it rapidly and too low in the boiler.

It might be well to post a picture or print of a damaged boiler on the bulletin board, where it will be noticed by the engine crews prior to leaving; this will impress them with the results of low water. It would not be necessary to show any names of the men or the railroad.

All locomotives should be equipped with some low water alarm or device.—*A. T. Pfeiffer, Syracuse, N. Y.*

It Can Be Done!

Boiler explosions (98% of the crown sheet failures are due to low water) are an embarrassment to railroads, an impediment to the war effort, and a source of loss in both life and property that is causing grave concern to those considered responsible; also to the public at large which naturally believes that something should be done about it and done quickly.

Water registering devices on American locomotives—low water alarms and other safety devices—are the best in the world. Our locomotive boilers themselves are built and maintained to and above Federal requirements; hence it is evident that the cause lies elsewhere. In a majority of cases the only ones who really know, or could help determine causes, are victims of such explosions. It would appear that engine crews become lethargic to danger signals—get "used to" the point of danger —until it is too late.

What can be done to help these otherwise capable employees? What suggests itself as a reliable check and safeguard to avoid such failures and ensuing injuries and property damage? Whoever can project such an idea, method or device will make a real contribution to humanity in general and to American railroads and their employees in particular, as boiler explosions are an unnecessary evil that can be eliminated if all concerned bend every effort to that end.

Old timers will recall some of the conditions we were called on to correct prior to July 1, 1922, and records show that these really were corrected to a minimum. It still remains to correct one of the most serious of all—low water crown sheet failures—and this must be done quickly. Railroad men should pool their experience and interests to that end—men in the shops and roundhouses, boilermakers, machinists and others, who have spent their working lives inspecting, repairing and supervising work on locomotive boilers and accessories, including water registering devices and alarms (safety or drop plugs)—being certain nothing is overlooked. And in your daily contacts with enginemen, seek their

confidence and impress on these knights of the road the functioning and importance of water alarm devices. Help them as never before and in your own efforts go beyond the "call of duty" to help your employer correct this evil that is taking such an unnecessary toll in life and property. To overcome such *now* is to make a patriotic and permanent contribution to humanity, to your employer and to the good old U. S. A. *It can be done.—William N. Moore, General Boiler Foreman, Pere Marquette, Grand Rapids, Mich.*

Boiler Drop Plugs Effective

This subject has been and is a live one on this railroad, due to water and grade conditions. We use boiler drop plugs on the Southern Pacific and believe, with the experience that we have had with them, that they are one of the best devices known for prevention of damage to boilers due to low water. In eleven years we have had 210 proved cases of low water, and were provided with complete protection against explosions in all but a single instance. Last year we experienced an all-time high in low water hazard of accidents, this increase being due to new and inexperienced enginemen, fire builders and engine watchmen.

The crown sheet on the Southern Pacific power is protected by from four to thirteen drop plugs, depending on the size of the firebox.

Instructions concerning the operation and handling of these drop plugs are framed and posted prominently in each locomotive cab and in the enginemen's and register rooms. One of these notices is shown in the illustration.

The best preventives against boiler explosions are:

An efficient and careful engine crew, fire builders and engine watchmen.

Boiler drop plugs spaced properly.

Water glasses and gage cocks that are known to be registering properly, and the fact fully realized that a full water glass is to be suspected as well as an empty one.

The importance of these factors should continually be emphasized by supervisors and others, and when this is done, the number of explosions each year will be materially decreased.—*R. N. Booker, General Road Foreman of Engines, So. Pac.*

Training of Engine Crew

This roundtable discussion, as the writer takes it, is an effort to reach the human element which enters directly into most unfortunate locomotive boiler explosions, regardless of the fact that many times, due to the members of the crew all losing their lives, the cause is placed on some faulty operating device, which would not have been dangerous at all, had proper steps been taken by the engine crew to make an examination or kill the fire while there was still enough water on the crown sheet.

Here are several of the questions and key answers used in our examination for promotion from fireman to the position of engineer which relate to boiler feeding and management by the crews in charge. The supervisor is required to see that all candidates understand their meaning at the time of the oral examination before they are passed as capable of taking charge of engines.

Q.—Do you understand that it is your duty and responsibility, upon taking charge of a locomotive, before each trip, or day's work, to examine the firebox and crown sheet and see that they are in proper condition? A.—Yes.

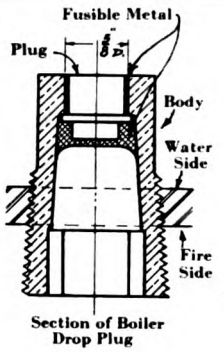
Q.—What means have you of determining the height of water in boiler?

A.—The gage cocks and water glass.

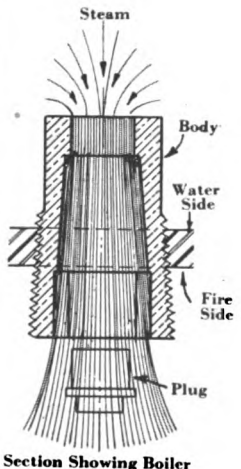
Q.—Do you understand that it is your duty and responsibility, before each trip or day's work, to blow out all water columns, water glasses, and test all gage cocks and to know that they are in proper condition, and that the gage cocks can be easily opened and closed by hand without the aid of a wrench or other tool?

A.—Yes.

Q.—Do you understand that it is your duty and responsibility before each trip, or day's work, to know that all tubular water glasses and lubricator glasses are equipped with a safe and suitable shield.



Section of Boiler Drop Plug



Section Showing Boiler Drop Plug in Action

NOTICE

All locomotive boilers are equipped with multiple application of BOILER DROP PLUGS for protection in case of LOW WATER

Boiler Drop Plug consists of a brass body into which is secured a brass plug held in place in the body by a ring of fusible metal which will soften or melt at a temperature between 550° F. and 575° F. The Drop Plugs are applied in the crown sheet of fire box, the number applied being in proportion to the size of the boiler. The Drop Plugs project above crown sheet and are covered with water when carried at proper level. With LOW WATER the Drop Plugs become uncovered, permitting the temperature of the Drop Plugs to rise to over 550° F.; this temperature will soften the fusible metal and the pressure in the boiler will eject the plugs, permitting steam to escape into the fire box.

The fusible metal is carefully alloyed and tested to insure proper melting point before being used in the manufacture of Drop Plugs and every lot of Drop Plugs is further tested to insure proper functioning temperature before being released for use in locomotives.

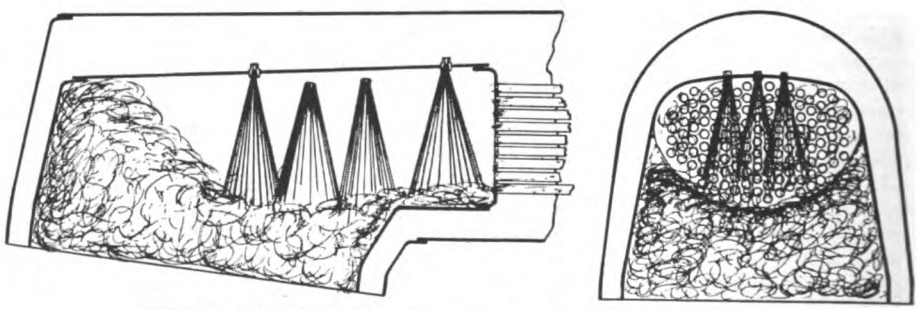
Account of size of boilers and the distance Drop Plugs are located from the fire door, they may not always be heard when they go into action, but the effect on the fire should easily be observed and any sudden change in the condition of the fire should be immediately investigated to see that the water is at the proper level in the water glass and gage cocks. If the water is found to be at an unsafe level, FIRE SHOULD BE IMMEDIATELY PUT OUT and examination made through fire door to determine if Drop Plugs have functioned. If Drop Plugs have not functioned water must be FIRST restored to proper level in boiler and THEREAFTER fire may be relighted.

WHAT TO DO WHEN BOILER DROP PLUGS FUNCTION

1. PUT FIRE OUT. CLOSE FUEL OIL VALVE OR SHUT OFF COAL SUPPLY. Do not operate injector or feedwater heater, and leave water and gage cocks in the condition existing when Drop Plugs functioned. Leave fire door closed.
2. On engines, if train being handled and if helper power or power from other trains is available, main track should be cleared and engine and train secured from moving. On light engines handle as instructed above and take any other action necessary to insure safety. Make telephone and wire report immediately to Superintendent, Chief Dispatcher and Master Mechanic and await instructions.

San Francisco, April 17, 1943.

SOUTHERN PACIFIC COMPANY


TYPICAL MULTIPLE APPLICATION SHOWING DROP PLUGS IN ACTION

Notices similar to this are posted prominently in each locomotive cab and in places where the enginemen congregate

which will prevent the glass from flying in case of breakage, and that such shield is in a proper condition? A.—Yes.

Q.—Do you understand that it is your duty and responsibility before each trip, or day's work, to know that all water glasses are supplied with a suitable lamp properly located, to enable the engineer to easily see the water in the glass?

A.—Yes.

Q.—Do you understand the proper method of blowing out a water glass to insure one that is registering properly and that this is the way an engineer must prove to himself that the water glass connections are free from any obstruction? Explain how this should be done.

A.—1. Close the bottom water glass valve.

2. Open the drain valve at bottom of water glass connection, blowing out water glass and drain valve thoroughly.

3. Close top water glass valve.

4. Open bottom water glass valve, blowing this valve out thoroughly.

5. Close drain cock at bottom water glass connection.

6. Open top water glass valve.

Q.—Do you understand that it is your duty and responsibility to compare the water level in the water glass with gage cocks frequently while on the road and while standing at terminals, and not depend entirely on the water glass?

A.—Yes.

Q.—Should the water in the boiler become disturbed and foam, what should you do, and how would you ascertain whether it was foaming or becoming overpumped?

A.—Would relieve the condition as quickly as possible by the repeated use of all manual blow-off cocks to the extent that water level in boiler will permit. Locomotive throttle should be eased off and cylinder cocks opened while the carry over is taking place. Water level indication in water glass, together with the trying or opening of all gage cocks, will determine whether the boiler water is disturbed or overpumped to a point of too high a water level.

Q.—What effect does shutting off the throttle have on the water in the boiler?

A.—It tends to lower its level.

Q.—What is important in carrying water in the boiler as to height and regularity?

A.—The boiler feeding should be consistent and uniform so that a constant level will be maintained. This is to be at a point high enough to protect the boiler and firebox sheets under all operating conditions ,and yet low enough to insure the working of dry steam and obtaining maximum superheat temperatures at all times.

Q.—What is an engineman's principal duty in regard to the care of the boiler?

A.—See that firing and pumping are handled at all times in a manner which will avoid any sudden or wide variations in steam pressure; such changes cause cracks, broken bolts, leaks, etc., due to the resultant rapid expansion and contraction.

Q.—Why is it necessary to pay strict attention to the blowing off point of the safety valve and make comparison with steam gage?

A.—In order to know that safety valves are functioning properly at the required setting and preventing the build-up of any excess pressure in the boiler.

Q.—What would occur if sufficient water was not kept on the crown sheet?

A.—Damage to sheet would result immediately, followed by the possibility of injury to the members of the engine crew.

Q.—How is the strength of iron and steel affected by being heated to red heat?

A.—It is weakened very quickly and the metal becomes soft.

Q.—Since the heat has this effect upon steel, how is it that the firebox and sheets, which are quite thin and are subjected to a high temperature and a high steam pressure per sq. in., can withstand such pressure without being either torn or deformed?

A.—There is water on the side of sheets opposite to that which is subjected to the heat. Heat is absorbed by the water.

Q.—Should a blowoff cock stick open or be broken off, or a hole be broken in the boiler in any way, what would you do?

A.—With blowoff cock stuck open, put on second injector to protect water level in boiler, and if necessary ease down or shut off throttle; after steam pressure is lowered it may be possible to close it; if not, it will be necessary to stop and close the globe valve in the blowoff cock waste pipe, if so equipped. In case of blowoff cock broken off at side sheet, washout plug blown out or hole in boiler, protect the firebox sheets by use of second injector, while dumping or hilling fire. If possible, allow train to drift into a siding.

Q.—In case a boiler tube should burst on trip, what would you do?

A.—It would depend on the location of the flue and how badly burst. In certain cases, if it is a lower flue, it may be possible to cover with green coal, and the same may apply on a locomotive equipped with fire arch with a flue in a similar location, thus making it possible to come to terminal with at least reduced tonnage. If in a location bad enough to put out fire, try to clear the main road before giving up, and notify superintendent.

Q.—What action should be taken in such a case, provided it is necessary to draw the fire?

A.—Try to clear main road before drawing fire; prepare locomotive to be towed, including lubrication of moving parts. During freezing weather it will also be necessary to drain boiler, water cistern, water pumps, injectors, feed and delivery pipes, hydro, lubricators, etc. Should the rods be left up some provision will have to be made for the rider or man in charge to warm up the mechanical lubricator; this will protect it from damage and insure lubrication to cylinders. This can usually be done by securing a supply of burlap and wrapping a piece around the lubricator occasionally and setting on fire. Should driving connection to the mechanical lubricator be broken beyond repair it will be necessary to warm some valve oil and then remove port plugs frequently, to pour oil into valve chambers; if followed up and perhaps supported with some rod cup grease enough lubrication will be assured to protect valves and cylinders while coming to a terminal. In case lubrication cannot be provided it will be necessary to take down the main rods and clamp valve control; also block crossheads securely.

Q.—Should the water in the boiler get too low to allow you time for examination, what would you do?

A.—Take immediate action to protect the crown sheet and other firebox sheets by dumping or smothering fire; this will depend on the conditions.

Q.—In case of failure of water supply in tank, or tank valve becoming disconnected in tank, what would you do?

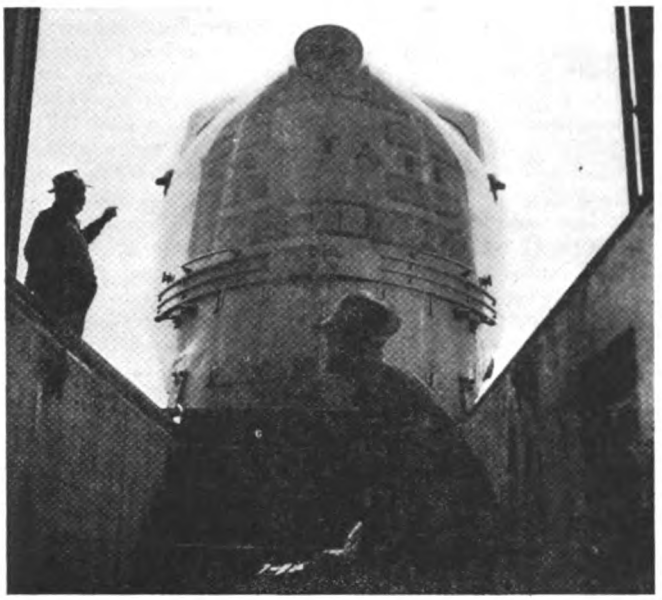
A.—It may be possible to run locomotive light to a water station, provided the distance is short, before water in boiler is exhausted or becomes too low to allow for refilling; or it may be possible to cover over or deaden fire and be towed to a water station in the event that another engine is available. However, conditions may be such that the fire will have to be drawn or dumped at once in order to protect the firebox sheets from being burned. If near a siding try to get train off main road, if possible. Should a tank valve become disconnected in closed position, use the other injector or water pump to terminal, as case may be, working the locomotive to the extent that will allow the remaining device to meet the boiler requirements for the remainder of the trip. It may be necessary to drain the cistern while standing at the water station, after which the cistern can be entered through the filling hole and tank valve stem connected up and valve opened. The cistern can be refilled before proceeding.

Road supervisors follow this up when riding engines or talking to the men, in an effort to keep them conscious of all of the factors, from the simplest, such as regular trying of gage cocks, to that of boiler requirements per minute under full load operation of locomotive. Also why it is essential to ease off or shut off at once, provided devices are not maintaining a safe running water level; how many gallons per inch various boilers contain at the region of the water glass; how many inches there are on the crown sheet when water level is at the lowest reading, etc. This is to make the men conscious of the fact that something has to be done at once when water starts falling to a dangerous level and that something, which is something other than to continue to work the engine, *has to be done right then*, regardless of the delay which it may cause.

To the writer there is nothing dangerous in being on an engine when one or both of the boiler feed devices lag or fail to work, provided the engine is eased off or shut off at once. With the boiler water at or near running level, there will be enough after the throttle is shut off to allow for a short inspection and perhaps to correct the trouble. *One full gage* is as good as a boiler full for this purpose. Should the examination fail to give results, the fire can be covered over or dumped as conditions warrant. If the crew continues to work the engine and keep the fire in the usual condition, the result is pretty sure to be a fatal explosion in the matter of a few short moments.—*Road Foreman of Engines.*

Santa Fe Diesel Shop Kinks

At the Eighteenth street, Chicago, Diesel locomotive repair shop of the Atchison, Topeka & Santa Fe, which was described in the *Railway Mechanical Engineer* of January, 1941, all classes of repairs, including light, medium and heavy, are made to Diesel electric loco-



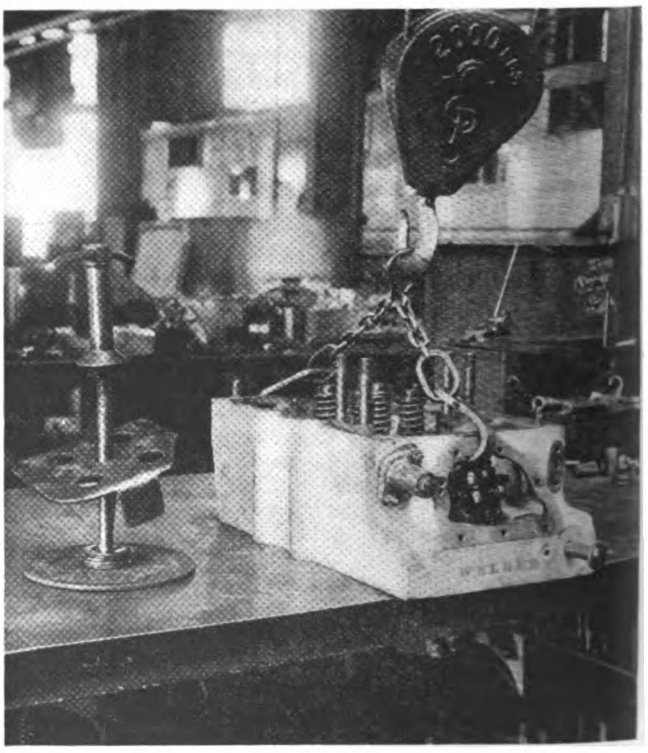
Pit view of a road locomotive entering the Santa Fe Diesel shop at Chicago

motives. The Santa Fe has 11 Diesel passenger locomotives and 10 Diesel switchers operating out of the Chicago terminal and 3 of the road locomotives have been given heavy repairs within the last few months after having made about 1½ million miles of service each. The normal output of the Diesel locomotive shop, with a total force of 86 men,* is about one heavy, two medium and 96 running repairs a month.

In addition to well-arranged inspection pits, Whiting hoist and overhead crane facilities for lifting locomotives, Diesel engines and other heavy parts, also for handling trucks and wheel work, one of the important features of this shop is the large number of ingenious tools and devices which are used to expedite the various repair operations. For example, one of the illustrations shows a Diesel engine cylinder head which has just been lifted from the floor to the work bench using a jib crane with special double-chain and hook device attached to the crane hook. One of the double chains (at the rear) is attached to a plate-type hook equipped with two lugs which engage the stud holes for water passages at the top of the head. The front hook simply is placed in the injector bell-crank-cover hole. With this type of lifting device, it is obvious that the cylinder head is held safely in a horizontal position and that there is no chance of slipping. The lifting hooks are both easily applied and removed.

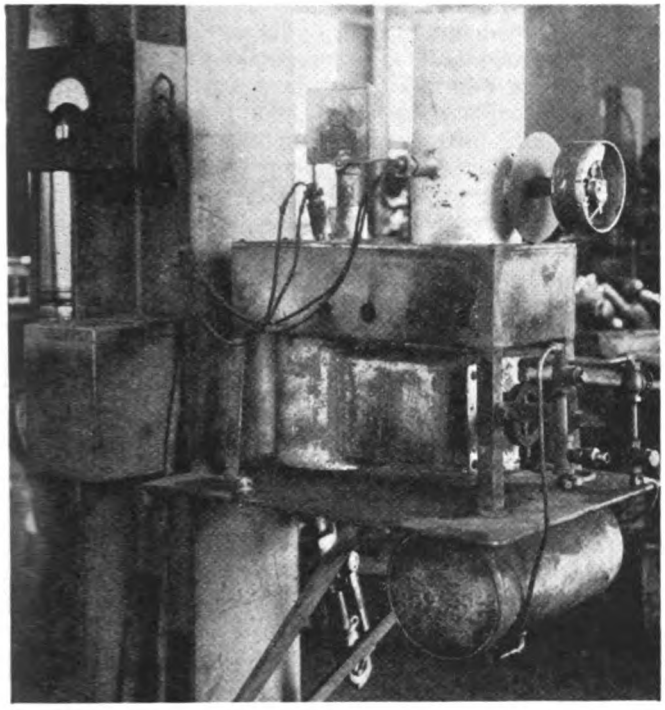
At the left of the head in the same illustration is shown a simple valve-spring-compressing device which greatly facilitates removing and applying the exhaust valves. This device consists of a circular bottom plate large enough to cover all four valve heads, a ⅞-in. bolt being welded to the center and carrying a special top plate which engaged the spring followers with a nut and hand-operated socket wrench on the upper end of the bolt for tightening purposes. The top plate, made of thin sheet steel to the shape shown has four holes large enough to go over the valve stems and also has a small hole at each back corner to fit over the rocker-arm studs as a guide. The lip on the front of the top plate is used to keep the top plate horizontal and thus assure compressing all springs equally.

In operation, this valve-spring compressing device is applied to the valve head with the center bolt extending through the injector hole in the head, the bottom plate covering all four valves and the special top plate engaging the spring followers. Operation of the hand wrench then tightens the top plate, compressing the springs and pushing the spring followers down over the locks which can then be removed. Backing off the nut then releases



Cylinder head lifting and valve removing devices

* Includes 3 supervisors, 2 clerks, 26 mechanics, 4 apprentices, 26 helpers and 25 laborers.

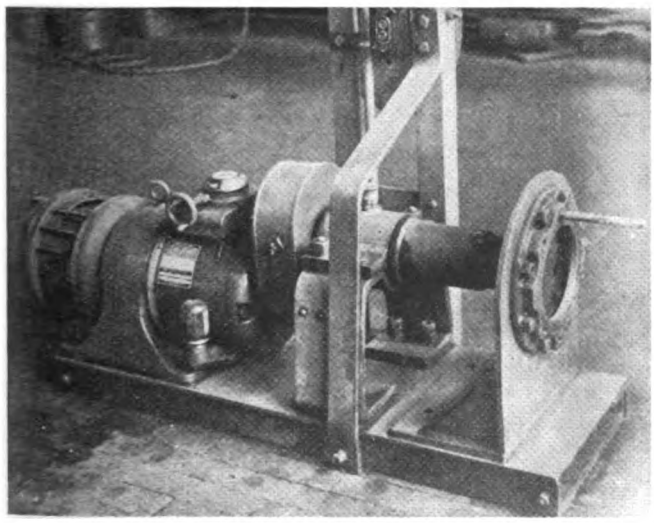


Device for testing steam temperature and stack switches

the springs and permits all four valves to be removed at one time. The reverse operation is used in reapplying new or reconditioned valves.

The next illustration shows special equipment supplied by the Vapor Car Heating Company and mounted conveniently on a building column for testing steam temperature and stack switches used in Diesel locomotive steam generators. This device consists of an atomizer with fuel-oil connection to the 2-gal. tank underneath the device and an air connection to the shop air line. The atomized fuel and air are sprayed into a combustion chamber, as illustrated, where intense heat is generated. Over this chamber is a sheet-metal housing which contains a lead pot in which the lower end of the steam temperature switch is emersed for checking. In the lead pot is an Alnor pyrometer element with an electrical connection to a temperature-indicating meter mounted on the post at the left.

Above the lead pot is a flue which leads to the 6-in. stack, 14 in. high, illustrated. In the side of this stack (at the right) is a hole for insertion of the stack switch as shown in the illustration. Another Alnor pyrometer element is inserted through the front of the stack with electric connections to the indicating meter to give an accurate reading of temperatures at which the stack switch operates. This device proves its value in checking steam temperature and stack switches which must be maintained within pre-determined close limits for satisfactory operation of the steam generator.

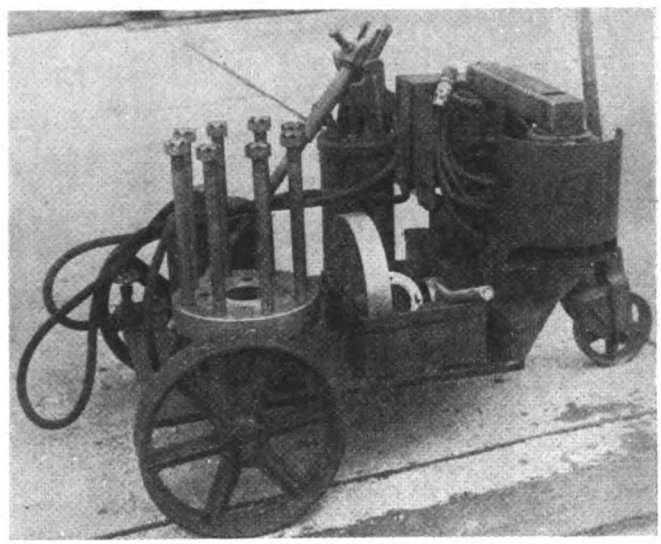


Variable speed device for testing speed indicators and train control governors

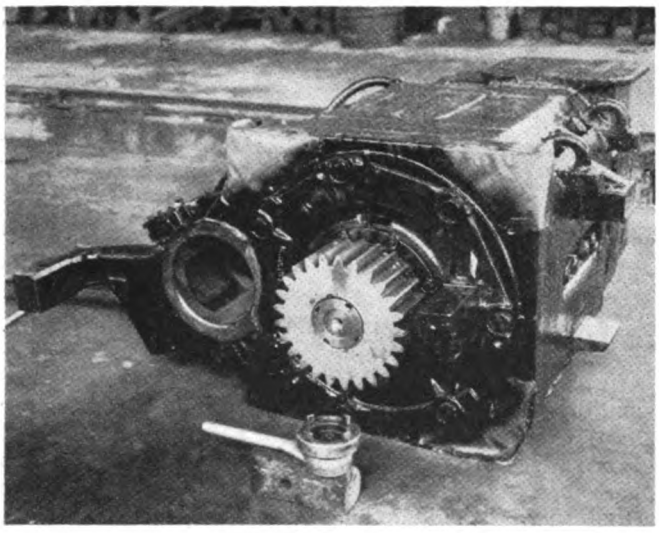
Another illustration shows a variable-speed device which is used in testing all types of speed-indicating devices for Diesel locomotives and train-control governors. This special testing equipment consists of a New Departure Transitorque infinitely-variable-speed transmission, driven by a 5-hp. induction motor and geared to a shaft which fits the drive of the electric speed-control governors. Adapters are provided for different types of electric or pneumatic speed control governors, the actual speed being checked by a hand tachometer. A lamp bank on the frame of the device is supplied by a small transformer, with a receptable where the governor contact plug is connected so that opening and closing points of all contactors are indicated.

Removing Motor Pinion Gears

A device, supplied by the Electro-Motive Corporation and mounted by the Santa Fe shop forces on a three-wheel truck, can be conveniently moved about the Diesel shop and used, as shown in the next three illustrations, for removing and reapplying traction-motor pinion gears. Referring to the general view of this device, an induction heating element will be seen at the right with a hand-operated hydraulic pump at the center and a hydaulic ram and stud gear puller placed at the rear. This pinion is a taper fit on the motor armature shaft and the first operation in removing a worn pinion is to unscrew the end nut with a special wrench. This wrench, shown resting on a small block of wood under the pinion in one of the views, has four hard steel lugs which fit into corresponding rectangular holes in the periphery of the pinion nut. The use of the pinion nut wrench, with a plate extension handle as long as may be necessary, enables the pinion nut to be backed off without any particular difficulty, the pinion being held against turning by means of a small metal block placed between the teeth and a steel block support on the motor housing.



Special equipment used in removing traction motor pinion gears

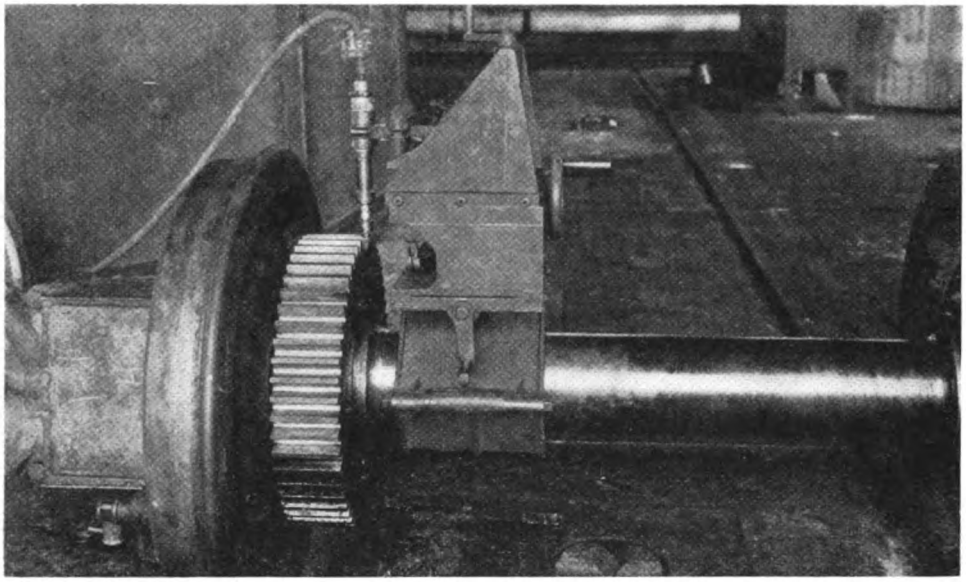


Special wrench used in removing the pinion end nut from motor shafts

position as illustrated. The passage of electric current through the induction heater under control of the switch illustrated then induces a magnetic flux through the laminated bar which serves to heat the pinion uniformly to just the right temperature required for the shrink fit on the armature shaft. In the particular motor illustrated the shrink fit of the pinion on the shaft is such that an advance of .055 in. to .065 in. gives the desired fit. This enlargement of the pinion shaft diameter can be secured with a temperature differential of about 130 deg. C. between the pinion and the shaft, the exact temperature being measured by a portable pyrometer which indicates to the operator just when to shut off the induction heater thus avoiding any possibility of overheating the pinion. After the pinion is applied and the pinion nut tightened, using the special wrench, this part of motor traction reconditioning is complete.

A Pinion Gear Tooth Grinder

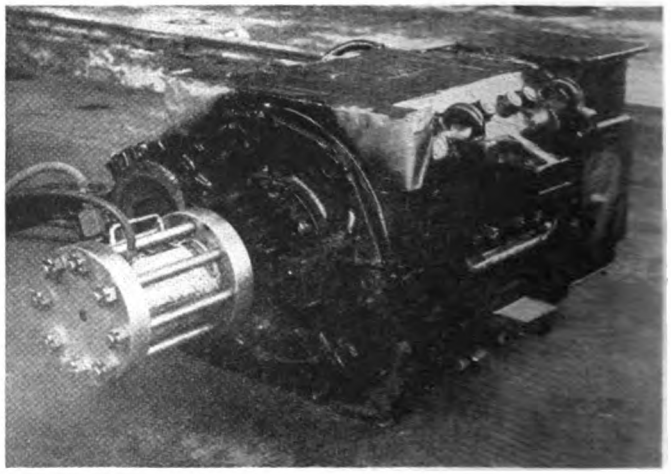
Traction motors in railway service are subject to unusually heavy duty and wear between the motor pinions and gears mounted on the driving axles is unavoidable. In maintaining the power trucks of Diesel locomotives, it is the practice of the Santa Fe to keep pinion



A portable grinder used in restoring worn tooth contours to standard

On removal of the pinion nut, the base plate of the gear puller is applied by turning its threaded extension end into the internal threads in the pinion. The cylindrical hydraulic ram, which is readily lifted by means of a small handle, is then applied within the studs of the gear-pulling device together with a small cylindrical spacer block and the circular end plate held by eight nuts as shown in another view. As set up, therefore, this gear-pulling device is rigidly connected to the pinion gear and the piston of the hydraulic ram bears against the end of the armature shaft through a hole in the base of the gear puller, the small spacer block transmitting pressure from hydraulic ram to the motor armature shaft. Operation of the hand operated hydraulic pump on the three-wheel truck therefore transmits as much pressure as required through the hose connection to the hydraulic ram to force the pinion off its shaft.

When ready to re-apply a new or reconditioned pinion, it is first set by hand on the motor armature shaft and its position checked with a special micrometer depth gage. It is then removed and placed on the heavy laminated iron bar of the induction heater mounted on the three-wheel truck, as shown in a separate illustration. This laminated bar is lifted out of place for application of the pinion and is then easily replaced in working



Gear puller in place ready to remove the pinion gear by hydraulic pressure

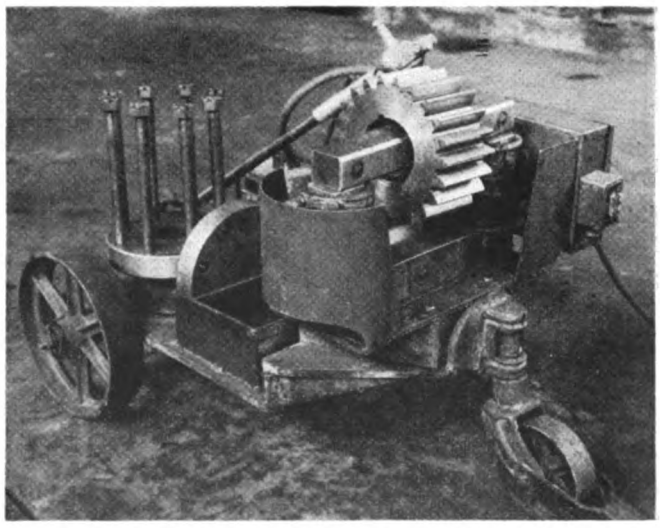
and gear sets together in the interest of smooth, quiet operation, and to avoid throwing excessive stress on gear teeth as would be the case, for example, in running a new pinion with a worn gear. As soon as the motor pinions and gears on Santa Fe Diesel locomotives show any appreciable wear, the tooth grinder, illustrated in one of the views, is used to bring the contour of the teeth back to the original by means of a slight grinding operation on each tooth. This does not change the tooth spacing in any way, but does give a slightly increased back lash, which is not objectionable.

The device used for this grinding operation consists of a compound rest, with slides in three directions, mounted on a V-fitting with a hinged plate clamp which can be readily applied around the axle inside the gear. On one of the compound rests is a fitting which holds a Chicago Pneumatic high-speed air motor which drives a small wheel, dressed to the proper thread contour. All teeth are ground and checked with a contour gage, the same amount of metal being removed from each tooth. The abrasive wheel is small in diameter, revolves at high speed and has a relatively limited service life, being frequently dressed to the proper contour and renewed whenever necessary. The operation of grinding a 55-tooth gear usually takes from four to five hours. It is estimated that the gear life is practically doubled by this gear tooth regrinding process.

Car-Wheel Grinder

The A. C. F. car wheel grinder, installed in the northwest corner of the Santa Fe Diesel locomotive shop at Chicago, is used to grind all types of car and Diesel locomotive wheels, wheel threads being made accurately round and concentric with the journals and flat spots being removed when necessary. Santa Fe passenger-car wheels are turned with cylindrical threads, but Diesel locomotive wheels are machined with standard taper tread contour. Wheels ground in this machine come out of the lathe with .010 in. of round and are ground within .002 in. with a limit of .005 in. The production of this grinding machine is about 15 pairs of steel wheels in eight hours.

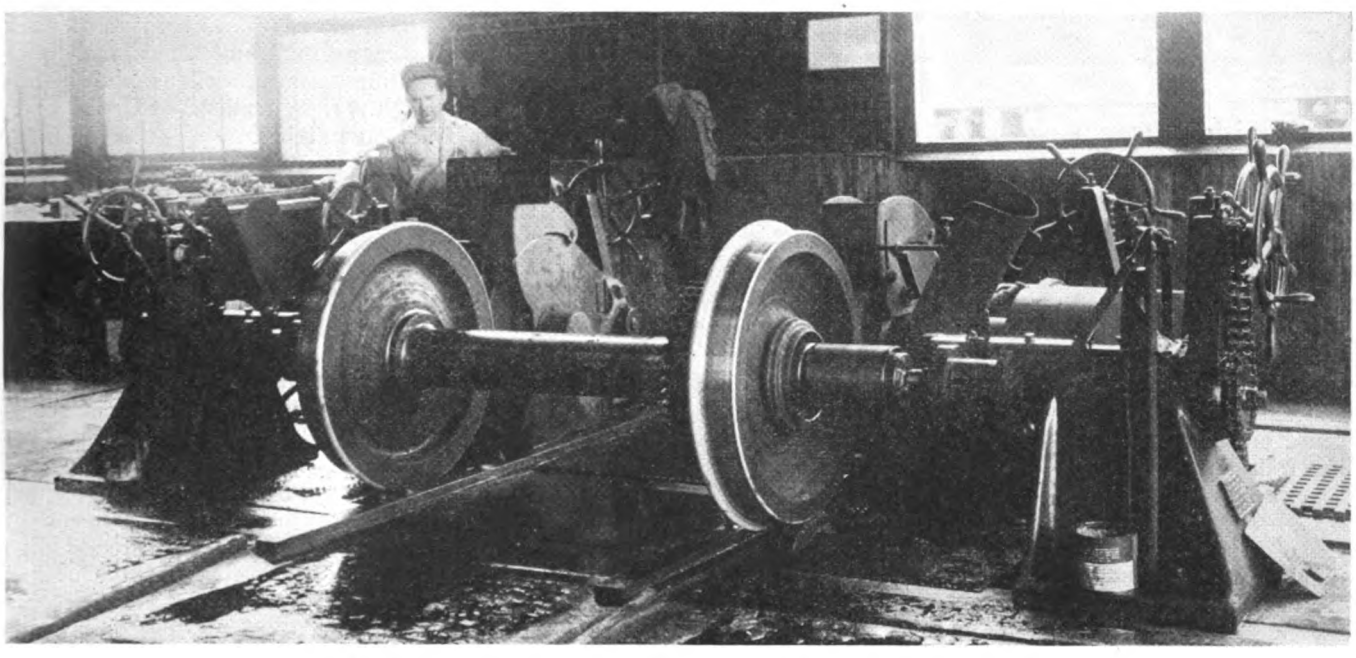
The A. C. F. grinder utilizes two 4-in. by 8-in. pneumatic tires carrying 90 lb. air pressure to revolve the wheels which are rolled into the machine and held between centers. Each of the 2¼-in. by 3-in. grinding wheels is driven by a 25-hp. electric motor with multiple V-belt drive. The grinding heads are adjustable longitudinally and laterally, and also to have the same angularity as the wheel tread. The depth of cut is indicated by power imput to the electric motor as shown by an electric meter.



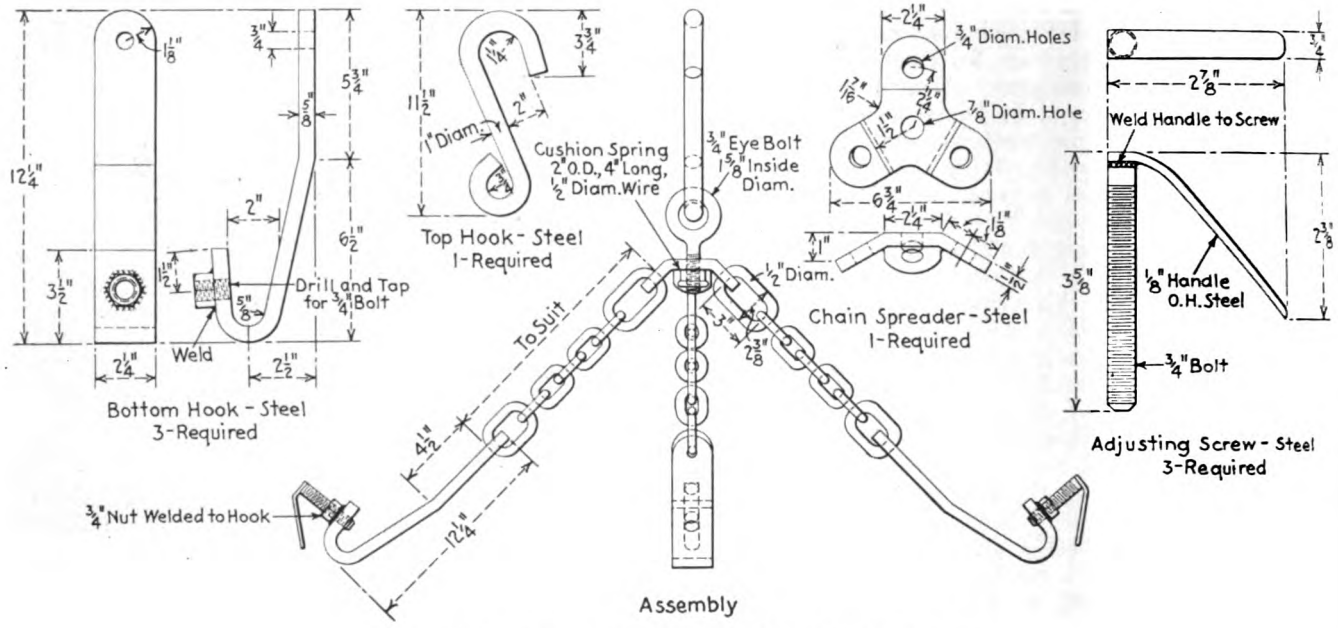
Induction heating device used in bringing pinions to the required temperature for re-application on armature shafts

Sling for Lifting Smoke-Stack Extensions

Many different devices have been developed around erecting shops and enginehouses for lifting draft pipes, or smoke stack extensions, and holding them in place while they are being bolted up inside the smokebox. One which came to our attention recently is shown in the accompanying drawing which consists of three chains



A. C. F. wheel-grinding machine installed at the Santa Fe Diesel locomotive shop



Details of the parts required for the smoke stack extension sling

with bottom hooks to go over the bead of the smoke stack extension, each hook having set screws to secure it in position. The three chains are secured to a spreader which in turn has a central eyebolt and S hook for attaching to the chain from the crane.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Hot-Finished Or Cold-Drawn Tubes?

Q.—Are hot-finished boiler tubes superior to cold drawn tubes, for use in locomotive boilers?—E. K. M.

A.—A committee of the Master Boiler Maker's Association favored hot finished tubes in preference to cold drawn tubes based on relative merits as follows:

"1—*Surface*—Cold-drawn tubes require soft annealing which is annealing at rather high temperatures. Such tubes have a surface scale which is not always as tightly adhering as might be desired. Hot-finished tubes, because of being mechanically worked by reelers and sizing rolls down almost to the critical temperature, have a more uniform, thinner, and closely adhering scale.

"2—*Crystalline Structure*—Cold-drawn tubes, because of more severe mechanical working in a longitudinal direction, show an elongation in crystalline structure which is sufficiently pronounced to be visible under the microscope even though the tubes are thoroughly annealed. This indicates a greater strength longitudinally than transversely. Hot-finished tubes show a more uniform crystal size and a structure which is uniform in any direction.

"3—*Physical Properties*—When a cold-drawn tube is annealed to such an extent that its elongation is practically the same as hot-finished tubes, the yield point and ultimate strength of the cold-drawn tube is from 5,000 to 8,000 lb. under the yield and ultimate strength of the hot-finished tube. These figures, from a tabulation of average results, indicate that hot-finished is stronger than cold-drawn with practically the same ductility.

"4—*Strength Under Pressure*—Hot-finished tubes, because they are finished above the critical point of the steel, are practically as strong transversely as longitudinally. They show higher bursting pressures than cold-drawn tubes, which fact is only partly accounted for by the higher physical properties. Cold-drawn tubes, because of the method of manufacture, tend to develop lines of weakness to transverse stresses which slightly lowers their resistance to bursting stresses.

"5—*Malleability*—Cold-drawn tubes, because of their longitudinal crystal structure, will not stand beading or other severe manipulating tests as well as hot-finished tubes which show slightly less tendency to split open under test than cold-drawn tubes.

"6—*Uniformity*—In commercial annealing it is difficult to hold all tubes to the same degree of final anneal and, therefore, cold-drawn tubes are not always entirely uniform as to physical structure. In the method of manufacture of hot-finished tubes there is more assurance of uniform structure.

"7—*Resistance to Corrosion*—As far as practical experience is concerned, we have found no appreciable difference in the resistance to corrosion of hot-finished or cold-drawn tubes. What difference there is seems to favor the hot-finished tubes. The department of metallurgy and research of a large manufacturer of boiler-tubes has checked up several investigations and references on the matter of the relative corrosion of hot-finished and cold-drawn tubing and has found that, while there may be some evidence that the hot-finished tubing corrodes less than the cold-drawn, the difference between the two is not very great although it is sufficient for them to be inclined to favor the hot-finished tubing in this connection.

"8—*Dimension Tolerances*—This is one point where cold-drawn tubes show an advantage over hot-finished. From the nature of the cold-drawn process it is quite evident that tubes can be furnished with smaller tolerance than is obtained on hot-finished tubes. In this connection, would refer to standard specifications for boiler tubes wherein cold-drawn tubes are furnished within a thickness tolerance of two gages while hot-finished tubes call for three gages variation.

"9—*Practical Service Comparison*—From what information we can gather, the service of hot-finished tubes indicates more mileage is obtained per flue setting than for cold-drawn tubes but, at the same time, all this cannot be credited to the hot-finished tubes as the change to long runs and water treating conditions have helped this. Of course, the most efficient manner in which to determine this definitely is to conduct a test in actual service; one side of the boiler being fitted with hot-finished tubes the other side with cold-drawn tubes. This test would run over a period of several years and, therefore, this committee is unable to state what the actual results would be."

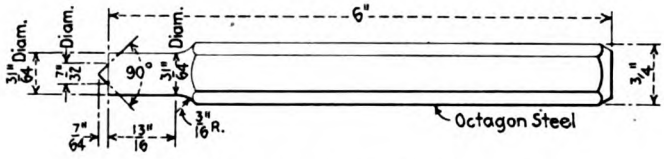
More About Side-Sheet Template

The accompanying illustration of a template used at the South Louisville, Ky., shops of the Louisville & Nashville for laying out half side sheets for locomotive boilers was first published as a filler cut in the March, 1943, *Railway Mechanical Engineer*. Considerable interest was displayed in this template and the following additional information is supplied through the courtesy of the L. & N. The template shown is made of ⅛-in. tank steel. It has ½-in. diameter holes punched in it, representing the holes to be punched or drilled in the side sheet. The template is merely placed in the proper position on top of the material that is to be used for the side sheet and clamped to the material with C-clamps. The hole locations are center marked through the holes in the template with a ½-in. center dab.

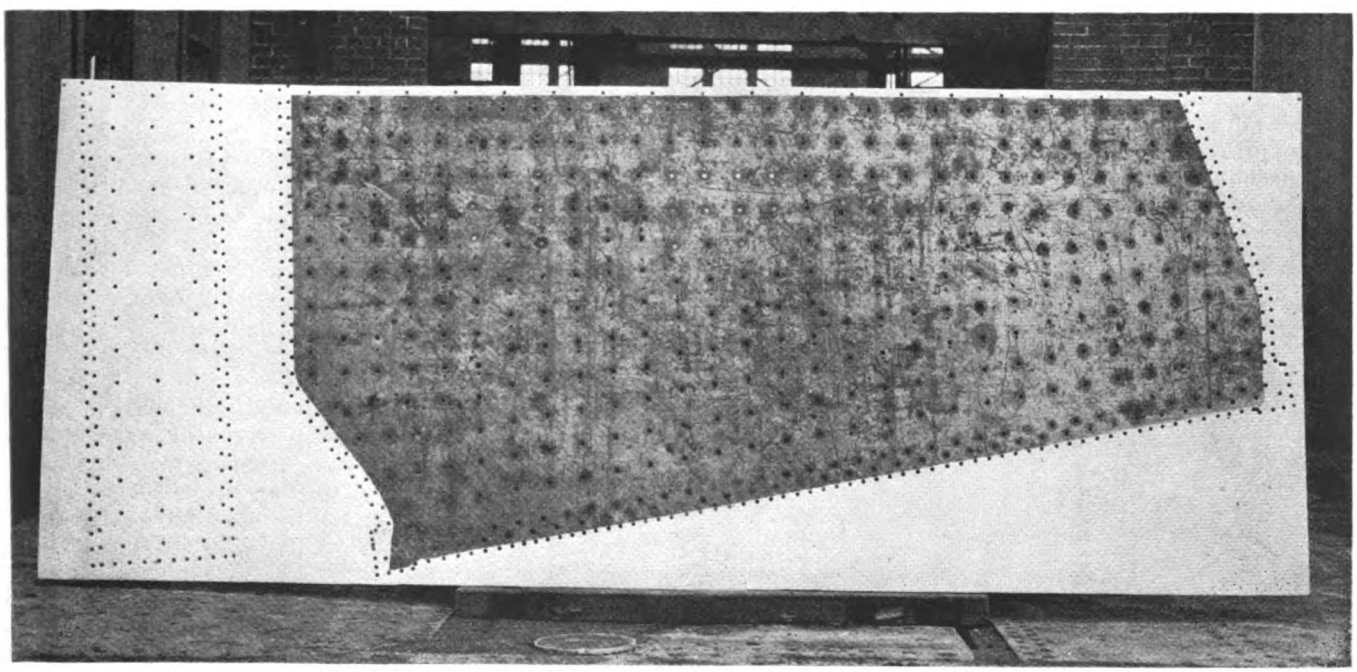
This template is used for J-3 class locomotive of which there are 93 on the L. & N. A slight variation is found in a few of the staybolt holes between those built by one locomotive works and those built by another. The 93 J-3 class locomotives are divided up in series thus: 18 were built by the Lima Locomotive Works in 1919; 15 were built by the Richmond Locomotive Works in 1920; 10 were built by the Schenectady Locomotive works in 1922; 30 were built by the Richmond Locomotive Works in 1922; and 20 were built by the Brooks Locomotive Works in 1923.

The variation in the staybolt holes between the series of the same class of locomotive mentioned above is taken care of by punching smaller holes in the template showing other series. When the side sheets are marked off from the template according to locomotive class the staybolts are never out of line.

The mud-rings of all locomotives built in the South Louisville shops are marked off carefully by using a level and straight edges to locate the lines for setting mud-ring templates. The holes are centered through the ½-in. holes in the template. The mud-ring is then plumbed and leveled on a four-spindle drill press and ¼-in. holes are drilled about ½ in. deep where the center marks were made. This operation is followed up by drilling the full-size holes. The small ¼-in. drill follows the center mark, and the full-size drill follows the ¼-in. hole accurately. No difficulty has been experienced with mud-rings drilled at builders' shops matching side sheets marked off from the L. & N. templates.



Center dab used with the firebox side-sheet template



Template used in laying out half side sheets for locomotive boilers at the Louisville & Nashville shops, South Louisville, Ky.

With the Car Foremen and Inspectors

Car Inspectors And Car Inspection*

By R. V. Ketring

The majority of people think of a car inspector, oftentimes referred to as a "Car toad," as a fellow with a hammer, dressed in overalls, walking around a train yard or car yard, tapping wheels. However, the Association of American Railroads have a different idea of the qualifications of a car inspector. He should have the following experience: Before being promoted to the position of car inspector, he should have one year at oiling cars, two years at car repairing. Age limit for new men, 30 years; age limit for promoted men, 40 years; vision 20/20 in one eye and 20/40 in the other, without glasses. He should be able to write English legibly, and also be able to read manuscript matter as well as printed matter; he should be able to name each part of cars in general, using A. A. R. terms and not slang terms. Must pass a satisfactory examination of at least 75 per cent—car inspectors examination—of the A. A. R.—loading—explosives—safety appliances, and other rules governing the handling of freight and passenger cars, of which there are 120 questions in our examination book. He should know and be familiar with I. C. C. defects, of which there are listed 269.

Car Inspection

On the railroads of this country, the complete and thorough inspection of all equipment used in traffic movement constitutes a very essential and important detail. Ordinarily, freight cars are inspected in receiving yards, classification yards at loading points, such as team tracks, freight houses, and on the various repair or shop tracks. Passenger cars are inspected enroute at stations where they pick up and discharge passengers, load and unload baggage, and in what are known as coach yards, where cars are cleaned and made up into trains.

Car inspection of passenger cars is generally divided into two classifications:

(1) Passing inspection at intermediate terminals, which constitutes making an inspection of all trucks, wheels, couplers and parts, safety appliances, testing and inspection of air brakes and steam heat equipment.

(2) Coach yard or preparatory track inspection, which constitutes a very thorough inspection of all parts of the cars, which includes testing of all equipment, such as electric and air conditioning, water system, air brake and steam heat equipment, inspecting and oiling all journal boxes.

On a good many railroads, they have inspection pits in their coach yards for the underneath inspection of passenger cars, especially for high-speed trains, better known to the public as streamliners.

Car inspection of freight cars is generally divided into three classifications: (1) train yards, (2) classification yards and (3) repair tracks. Some railroads use the following symbols for inspection: *A* for train yards, *B* for classification and *C* for repair tracks.

Train yard inspection is handled in yards where trains arrive and depart; on some roads trains are given inbound inspection. Then, when a train is made up, all that is necessary is to attach the outgoing engine and then test the air brakes. Other roads give outbound inspection by waiting until train is made up, then they give it an air test, and the usual inspection is given, which is an inspection of all trucks and parts, couplers and parts, safety appliances, air brakes, etc.; all loads are inspected to see that they are properly loaded according to rules, and journal boxes inspected and oiled. However, not all division points are oiling stations; they are generally spaced about 600 to 800 miles apart.

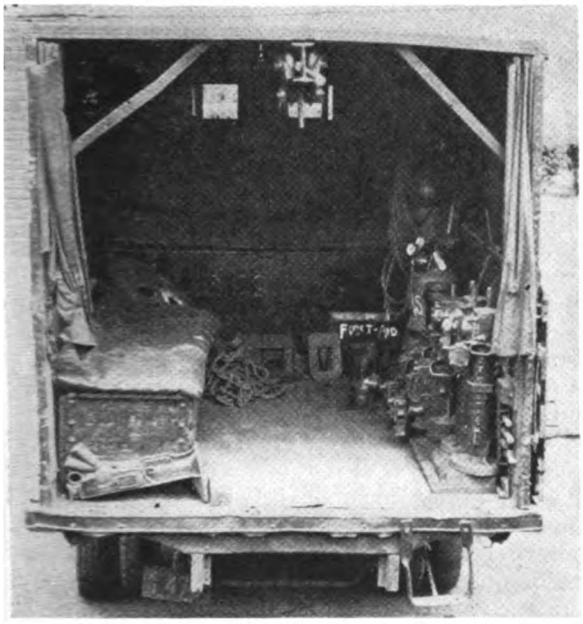
Classification yard inspection is generally handled where empty cars are assembled, such as storage yards, light repair tracks in train yards, freight houses, industry tracks and team tracks. On inspection of cars in these locations, they are given a thorough inspection to determine for what class of loading they may be fitted, such as on house cars, they are divided into four classifications, *A, B, C* and *D*; *A* and *B* cars are for high-class freight, such as sugar, flour, merchandise, beans and other similar commodities; *C* and *D* cars are for lumber, tin plates, sheet steel and rough freight of all kinds. Refrigerator cars are inspected, and on some roads they are classified as *R-1* for first-class perishable loading, *R-2* where cars contain ice in bunkers and it is not removed, or the cars are otherwise unfit for *R-1* loading. *R-3* cars are without floor racks and are fit only for canned goods or similar commodities.

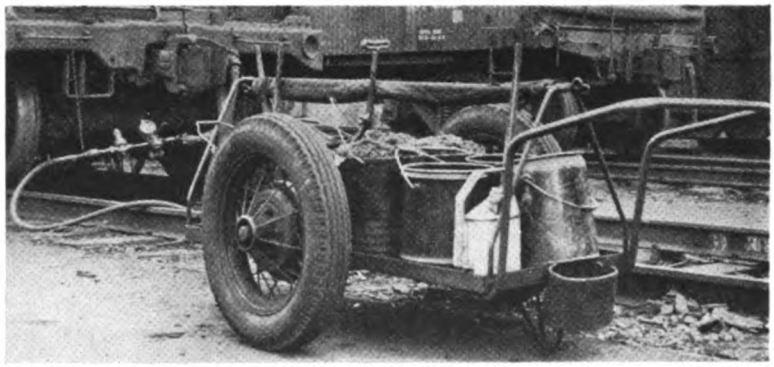
Other freight cars, such as tank cars, coal cars, and flat cars, are given the same kind of inspection; they are not generally separated into different classes, but are picked out for the different kinds of loads.

In making this inspection, in addition to determining what class of commodity the car is fitted for, the air brakes, trucks and parts, couplers and parts, safety appliances, doors, roofs, etc., are thoroughly inspected to know that the cars are fit to be loaded and carry their loads to destinations without delay.

Repair track inspection is generally handled on tracks known as car-shop tracks, rip tracks or repair tracks, and the majority of the cars reaching these tracks are cars that are bad ordered, for they are given a thorough inspection, and if any additional defects are found, necessary repairs are made. When cars are on these tracks they are also thoroughly inspected for heavy repairs. Thus, a car that may be bad ordered for old air date, when inspected may be found to have flooring, siding or other parts that are in need of repair; the car is then sent to the heavy repair track for necessary attention.

* Abstract of a paper presented at the August 12 meeting of the Pacific Railway Club held at Los Angeles, Calif.

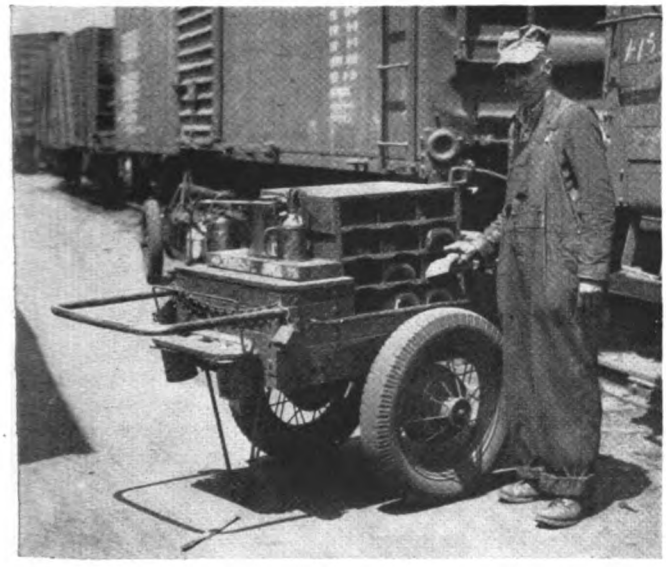




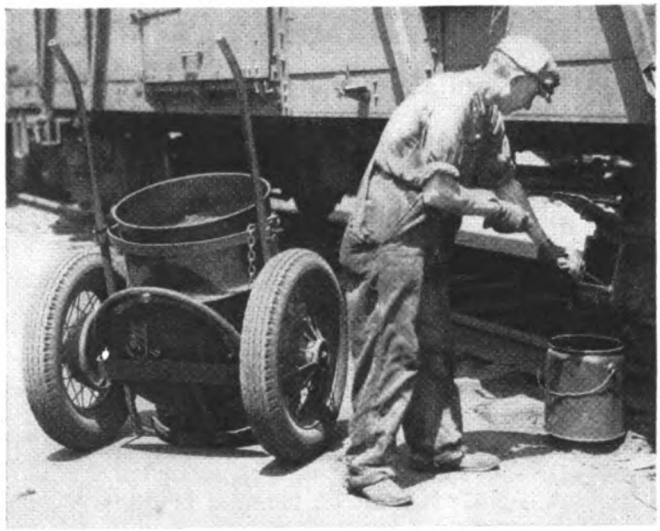
Above: Cart for box packers on which are carried nine buckets of waste, oil for free oiling, and a packing iron—The canvas cover protects the waste in rainy weather—Left: A truck equipped for light wrecking operations used on derailment calls—Equipment includes a two-ton chain hoist, two 50-ton jacks, two 15-ton jacks, burning equipment, blocks and wedges, track jacks, chains, replacers, new brasses, and flares and acetylene lights

Helps for the Car Foreman

Erie's Penhorn Shop Speeds Servicing



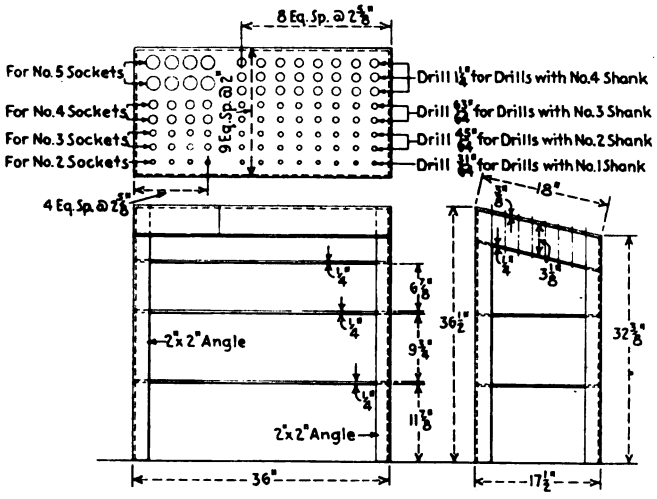
Left: Service cart for the use of men employed to check and replace bearings—Twenty-four bearings of various sizes can be carried in the rack—The cart also is equipped with a journal jack and necessary blocks, a can of car oil, a bar, paint and stencils for changing the packing date on a car, and other miscellaneous small tools which are, from time to time, required



Right: A pneumatic-tired cart which is used to carry a drum into which is placed waste removed from journal boxes—The cart is easily pushed about the car yard and readily maneuvered in close quarters—When full, the drums are covered and loaded in a stores-department cart for forwarding to the waste-reclamation plant

Shop Table for Sockets and Reamers

The numerous sizes of drills and drill sockets having Morse taper shanks that are used around tool rooms and at drill press locations always present a problem of storing in an orderly manner so that the proper size may be readily selected. One way of doing this



Welded metal stand for storing taper shank drills and sockets

is by the use of a steel table constructed, as shown in the accompanying drawing, after the style of a desk. This table has a top 18 in. wide by 36 in. long, designed in such a manner as to provide storage space for 64 drills, having Morse taper shanks from Nos. 1 to 4, inclusive, and 28 sockets having Morse tapers from Nos. 2 to 5, inclusive.

The table is constructed of 2-in. by 2-in. angle legs with ¼-in. steel plate shelves and a ⅜-in. steel plate top. Welding is used for assembling. The sizes of the holes to be drilled in that end of the table used for drills are shown in the drawing. The holes in the opposite end of the table should be drilled $^{45}/_{64}$ in. for No. 2 sockets; $^{63}/_{64}$ in. for No. 3 sockets; 1¼ in. for No. 4 sockets and $1^{23}/_{32}$ in. for No. 5 sockets.

Air Brake Questions and Answers

Installation and Maintenance of Axle Generators

208—*Q.—How would you proceed to remove the armature and bearings?* A.—To remove the armature and bearings first take out the four bolts (Ref. *48*, Fig. 10) in the rear end bell, and then remove the end bell by tapping the inside surfaces with a rod or bar of suitable size to pass between the inside of the generator housing and field assembly clamping bolt. The Type A drive may be removed from the armature shaft either before or after the end bell has been taken off. When reapplying the armature and end bell to the generator housing extreme care must be taken to follow the detailed instructions supplied by the manufacturer.

209—*Q.—Does this same rule apply to the Type B drive?* A.—No. It must be removed before the bolts can be removed.

210—*Q.—Is it necessary to remove the metal disc at the front of the generator in order to remove the armature?* A.—No.

211—*Q.—What attention should be given the generator periodically?* A.—It should be removed periodically from the journal box, cleaned thoroughly, inspected and lubricated in accordance with manufacturer's instructions.

212—*Q.—How is the voltage test made?* A.—Place the generator in a suitable rack provided with means for turning the armature at a known speed, not less than 600 and not more than 900 r.p.m. A voltmeter should be connected to the two brush holders and the generator loaded by means of a resistor in accordance with the manufacturer's instructions.

213—*Q.—What is the allowable voltage value, and what should be done if it is too low?* A.—The voltage delivered when loaded must be between the minimum and maximum values as given on the graph furnished. If the voltage is not within the limits shown on the graph, the output may be adjusted in accordance with detailed instructions from the manufacturer or may be returned to the manufacturer for adjustment.

214—*Q.—What is the polarity of the brush holder on the side of the generator opposite the cable outlet when the armature rotates in a clockwise direction?* A.—Positive (+) when the armature rotates in a clockwise direction as viewed from the front.

Back-Up Valves

215—*Q.—What types of back-up valves are used?* A.—The Type B2 (Fig. 7) and DE-1 (Fig. 6).

216—*Q.—Where and when is the Type B-2 used?* A.—On rear cars from which back up movements are controlled only when the automatic brake is used in the head end.

217—*Q.—Is it used when the HSC electro-pneumatic brake is used on the head end.* A.—No. It is not intended for use in this case.

218—*Q.—What pipe connections does this valve have?* A.—Two ¾-in. pipe connections; the one at the right connecting to the brake pipe, the other to the exhaust.

219—*Q.—Describe the operation of the B-2 back-up valve.* A.—A lever type handle *20*, operates key *4* and a curved slide valve *7* which is seated over a tapered port in bushing *3*. As the handle is turned in the direction of the arrow cast on the body, the slide valve uncovers an increasing area of the tapered port *k* permiting brake pipe air to discharge to the exhaust. The total movement for complete opening, which is emergency position, is 90 deg.

220—*Q.—What is there about the construction of the valve which permits gradual opening?* A.—The face of the slide valve is recessed with bearing surfaces only at the edges. This provides a low bearing area which with the lever handle permits gradual opening and, therefore, has the ability to control the reduction rate in accordance with train length.

221—*Q.—What provides for back-up movement?* A.—A whistle is provided for back up movements. This is operated by button *14*, which moves stem *16* and unseats valve *15*, admitting air to the whistle valve pipe. The tap for this pipe is ⅜-in. Spring *17* is light, sufficient to insure seating of the valve but low enough to permit easy button operation.

222—*Q.—Of what does the DE-1 back-up valve consist?* A.—It consists of an electric portion and an automatic portion, both operated from the same handle and shaft. Contact drum *11* controls three contact fingers *30*,

which are connected to (*1*) application wire, (*2*) release wire, (*3*) the positive (+) battery wire at plug connector *35*. Rotary valve *17* controls venting of brake pipe air from connection *39* to the exhaust in accordance with the handle position.

223—Q.—How many handle positions does this valve have? A.—Seven, indicated by quadrant notches.

224—Q.—Name the positions. A.—Electric release, electric lap, electric application, and automatic lap and automatic application, including last four notches.

225—Q.—Describe the electric release position. A.—Brake pipe exhaust closed, all electric contacts open.

226—Q.—Describe the electric lap position. A.—Brake pipe exhaust closed, drum connects upper and lower finger contacts, thereby closing battery wire (*3*) to release wire (*2*), thus energizing the release magnets of the *21-B* magnets which close their exhausts and retain brake cylinder pressure.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Splicing and Painting Tank Car Jacket Sheets

On August 31, 1941, N. A. T. X. car No. 9531, a class 3 insulated asphalt tank car was derailed and overturned on the Texas & Pacific. On September 6, the car owner, the North American Car Corporation was requested to furnish the A. A. R. depreciated value. This was given on September 8. The car was moved to a T. & P. shop and the owner advised that repairs would be made. The T. & P. released the car on December 18 and it was moved to the owner's shop where a joint inspection was made. The owner, on the basis of this inspection, requested defect cards to cover numerous improperly repaired and unrepaired items. The T. & P. issued its card for a number of the items and the case was resolved into a determination of the following questions; whether a tank jacket head was improperly straightened when it was still bent and cut; whether a car was improperly cleaned and painted when paint was applied over asphalt on parts which had not been damaged and repaired; whether welded splicing of tank-jacket sheets was permissible when the car owner's standard with reference to weight and thickness was followed and the splices were in inconspicuous locations; whether a spliced jacket dome sheet violated car standard; whether 24-in. welded splice plates instead of 36-in. plates on the center sills were wrong repairs; and, whether a tank test was required merely because the car had been turned over when the tank showed no visible defect.

In a decision rendered November 16, 1942, the Arbitration Committee ruled that: "Rule 16 permits patching of tanks of tank cars and, therefore, the splicing or patching of jacket sheets is not considered wrong repairs. The presence of asphalt on the empty tank cars is an owner's responsibility. The nature of damage to the tank did not require a test after completion of repairs. Handling line should issue additional defect card for the tank jacket improperly straightened and center sills improperly spliced."—*Case No. 1790, North American Car Corp. versus Texas & Pacific.*

Allowance for Wheel Removal to True Journals

Cars of both the Atlantic Coast Line and the Florida East Coast operate in high-speed passenger service over each other's lines. When wheel changes were made on A. C. L. equipment by the Florida East Coast, the latter was charging full labor allowances under Items 21, 22 and 23 of P. C. Rule 21 when it was necessary to true journals but where neither wheels nor axle were scrap. The A. C. L. contended that it should not be penalized because another road lacked facilities to turn journals without dismounting wheels. Its claim was that Item 24 of P. C. Rule 21 applied.

The Committee on November 13, 1942, decided that: "Since neither wheel nor axle was scrap, the deduction specified in Item 24 of Passenger Rule 21 is in order. The contention of the Atlantic Coast Line Railroad is sustained."—*Case No. 1793, A. C. L. vs. F. E. C.*

Service Life of Emergency Bearings

As a part of the National program inaugurated in December, 1941, for the conservation of critical and scarce materials, the General Committee appointed a Special Committee on Journal Bearing Development to investigate the possibilities for the conservation of critical metals in car journal bearings. This Special Committee carried out an extensive laboratory research involving the study of bearing modifications with particular reference initially to the possibilities for the conservation of copper, tin and other critical metals by the reduction in weight of the bronze back—babbitt lined A. A. R. type bearing within the limits of safe performance.

As a result of these studies the present Emergency design of bearing was adopted and went into production during the second quarter of 1942. A circular letter issued under date of August 16 by the Mechanical Division calls attention to the fact that, starting in the New England District early this year, it was reported that the Emergency bearings were not standing up in service and since that time complaints of this character have been received from several quarters in the United States and from Canada. These reports infer that the Emergency bearing is structurally weak and that hot boxes are developing in large numbers account of the inability of the Emergency bearing to stand up in every-day service.

"The several complaints directed to this office," the letter continues, "have been referred to the Special Committee on Journal Bearing Development and to the Lubrication Committee and were considered at length at a joint session of these two committees held on May 19, 1943, and again by the Special Committee at a meeting held on July 14-15, 1943, at which meeting a sub-committee was appointed to make a full report based on a survey now under way.

"As preliminary to this complete report, the Mechanical Division states that the following facts which have been developed by the Special Committee as relating to their investigation of the specific complaints referred to them:

"1—From laboratory tests carried out by the Com-

mittee, they know that stock bearings of the emergency design will carry full journal load at speeds up to 100 m.p.h. with the atmospheric temperature around 100 deg. F. without developing abnormal running temperatures or showing greater deformation than the pre-standard bearing.

"2—Thickness of the bronze back of the emergency bearings at the crown is the same as that of relined bearings run on the railroads of the country for year prior to the adoption of the emergency design.

"3—Inspections of considerable numbers of bearings in scrap at various points in the country by the members during 1943 have shown that the emergency bearings in scrap up to this time may be classified under two general headings: (a) Those removed at wheel changes after relatively short service. The majority of these bearings are in good condition and could be reapplied to journals of proper size and would make many miles of additional service. (b) Those involved in over-heatings; evidence of originating cause not apparent from condition of scrap bearing but generally following the pattern of like failures of the pre-war design—over-heating to degree to cause lining flow or lose lining entirely, followed by the cracking or breaking up of the bronze back.

"4—The committee members find that the foundation for the reports being circulaated is apparently the cracking and breaking of the bronze backs of these bearings involved in over-heatings and a generally prevalent belief that the reduced lining thickness and weight reduction of the bronze backs are the originating cause of the over-heating of the Emergency bearings so involved.

"5—Inspection of any accumulation of journal bearing scrap will show that the cracking and breaking up of the bronze backs of all car journal bearings involved in over-heatings is a typical condition. Pre-war bearings fail in the same manner and from the same cause, namely, an inherent characteristic of hot shortness of the bronze material from which both the Pre-war and Emergency car journal bearings are made.

General Facts Applying to Car Journal Bearings

"1—Along with the change in dimensions, the specification covering the composition of the material in car journal bearing backs has been changed as a conservation measure. The present specification permits of a higher lead content at the expense of copper and tin in the Pre-war specification, thus, the composition of metal in the backs may increase the hot shortness by reason of a higher lead content.

"2—Government orders limit the tin content in all solder used in industry and has made it necessary to change the solder used for bonding linings to backs of car journal bearings produced during the past several months.

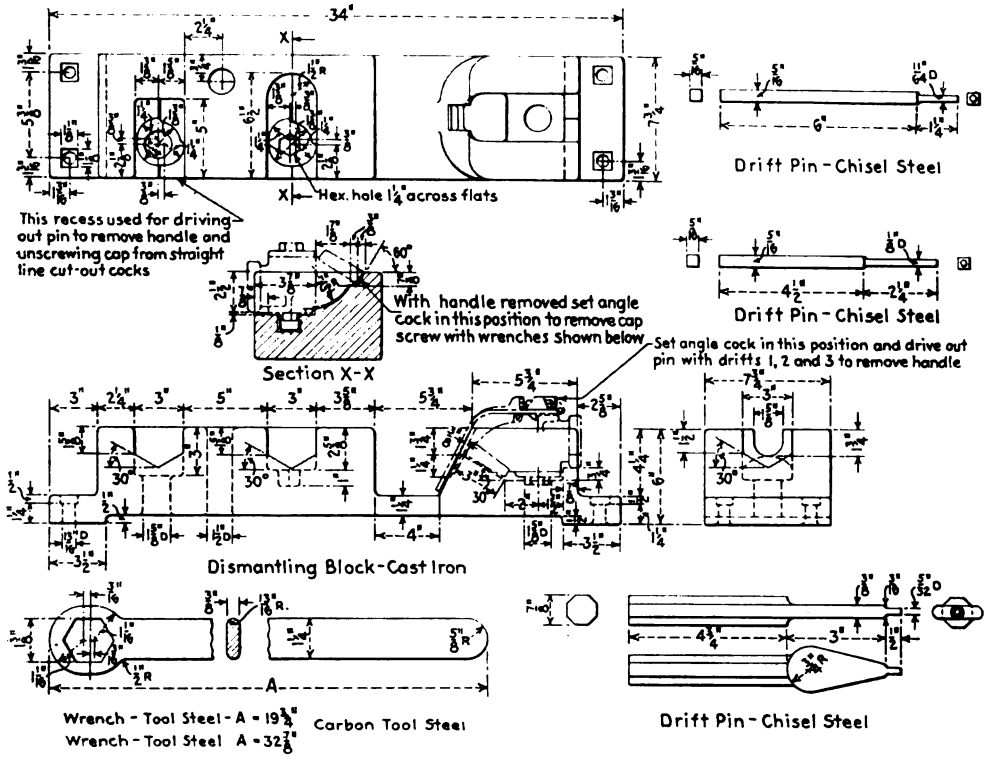
"3—During the transition period from Pre-war to Emergency bearings, manufacturing difficulties by reason of the reduced lining thickness resulted in the production of numbers of inferior Emergency bearings.

"4—The elimination of the individual railroad markings on the Emergency bearings, as a conservation concession to the bearing manufacturers, has apparently resulted in numbers of these inferior bearings getting into service.

"5—The available facts to date indicate that, with comparable materials and workmanship, the Emergency design represents an improvement rather than a backward step in car journal design.

"In conclusion, the Special Committee invites member roads to continue making reports covering the service of the Emergency design bearings but ask that these reports be limited to failed bearings *which have not been involved in hot boxes.* The Committee will be particularly interested in Emergency bearings showing cracked or broken backs, sheared lugs or collars and worn through linings (crown or sides) and will appreciate it if bearings showing unusual failures of these types be sent to the Committee at the Indianapolis Laboratory, care of William I. Cantley, Chairman, 510 South Harding Street, Indianapolis, Ind."

* * *



Block for Dismantling Air Line Cocks

The accompanying working drawings show the details of a dismantling block for use on the bench in the air brake repair shop. The cast iron block, which is secured to the bench by four bolts, has three recesses into which the cocks are placed. The drawings show how the cocks are inserted in the right-hand recess while the pins which secure the handle are driven out. The second recess is for removing the cap screw and the third recess for holding the straight-line type of cut-out cocks while removing both the handle pins and cap screw.

ELECTRICAL SECTION

Circuit Calculator

A small calculator, which takes the place of several conversion tables, for determining current and voltage values on various types of circuits, and conversely kva., kw. and hp. values when voltage and current is known, has been developed by V. W. Palen, Editorial Service, Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., and is now being distributed by that company.

It solves single- and three-phase problems expressed by the following formulae:

(a) Single phase

$$\text{Kva.} = \frac{\text{volts} \times \text{amp.}}{1{,}000}$$

$$\text{Kw.} = \frac{\text{volts} \times \text{amp.} \times \text{p.f.}}{1{,}000}$$

$$\text{Hp.} = \frac{\text{volts} \times \text{amp.} \times \text{p.f.}}{746}$$

(b) Three phase

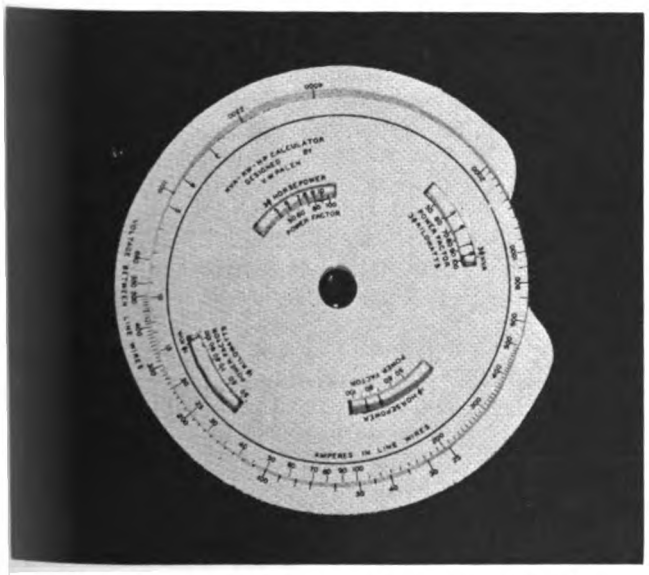
$$\text{Kva.} = \frac{\sqrt{3} \times \text{volts} \times \text{amp.}}{1{,}000}$$

$$\text{Kw.} = \frac{\sqrt{3} \times \text{volts} \times \text{amp.} \times \text{p.f.}}{1{,}000}$$

$$\text{Hp.} = \frac{\sqrt{3} \times \text{volts} \times \text{amp.} \times \text{p.f.}}{746}$$

The range of the calculator, 5 to 200 (kva., kw. or hp., as the case may be), can be extended easily to cover a range of 50 to 2,000 by multiplying all values by 10. It can be used to find kva., kw. or hp. from known values of current and volts; similarly it will determine amperes for given values of voltage, kva., kw. and hp. Thus, knowing the size motor to be installed, an electrician can quickly determine amperes—from this he knows what size wire to use for the circuit. Conversely, having read amperes at transformer terminals, the calculator tells what load, in kva., the transformer is carrying.

The calculator as distributed consists simply of two dials printed on a piece of 8 in. by 10 in. silver print paper. The recipient must mount these on cardboard, cut out the slots, trim the edges and mount the dials one on the other by means of a small bolt through the center.

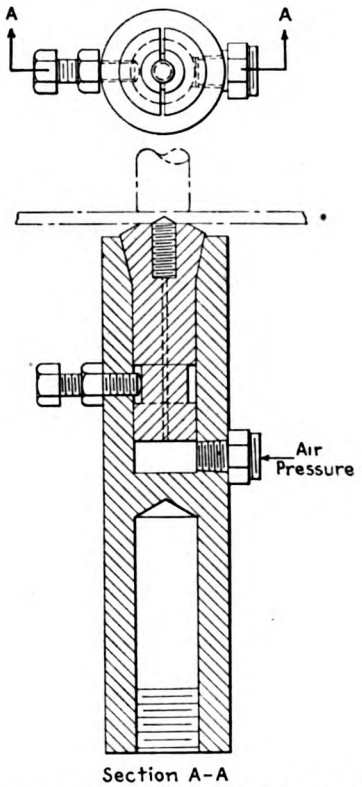


The calculator as made up from the prints supplied by the manufacturer

Device Improves Projection Welding

A device which makes practically fool-proof the projection welding of steel studs on metal hinges and sheet metal surfaces has been perfected by Andrew Camprielo, a foreman and spot welding expert at General Electric's Schenectady works.

The device calls for a vertically-milled slot in the collet, which is located in the bottom electrode. The collet is tapered. When the stud is introduced in the collet and the upper electrode is depressed, the jaws of the collet close tightly about the stud. The resulting pressure causes the current to be distributed evenly on all sides, and at the top of the stud near the welding zone rather than through the entire stud and then to the sheet.



Section A-A

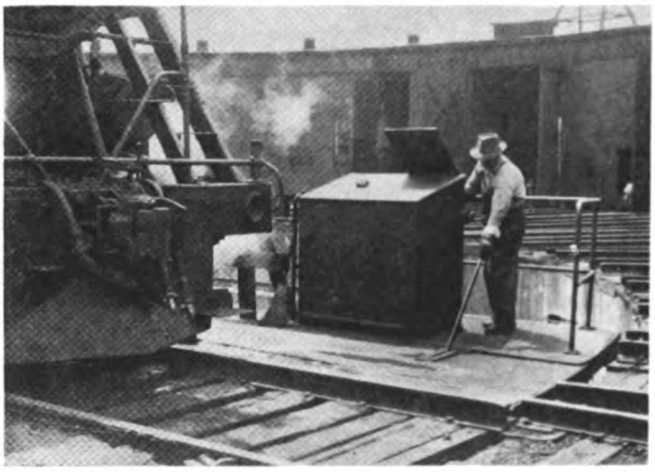
The jaws of the collet, which hold the stud to be welded to the plate, are released by air pressure at the moment the weld is completed

Below the collet is a space for air, forced in under pressure by a hose. As soon as the welding is complete and the upper electrode lifted, the air pressure forces the tapered collet upward. The collet expands and releases the stud. "Binding" of the stud on release was formerly a problem.

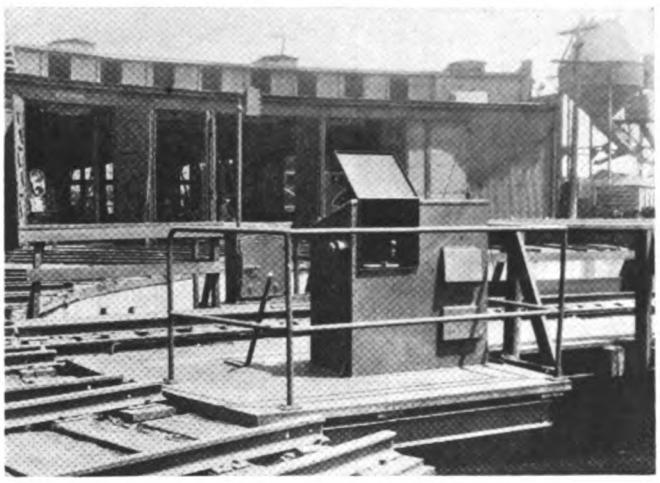
When the collet reaches a height sufficient to release the stud, its movement is stopped by a setscrew which engages the bottom of the collet.

Cabless Turntables

For locations where the operation of the turntable is intermittent, the Chicago, Rock Island & Pacific has developed a cabless turntable. The usual cab is replaced with a metal cabinet, as shown, which has a covered



The controller and brake handle are conveniently located



The turntable controller cabinet with the controller door open

opening for the controller handle and two others allowing for access to the contactors and fuses. The brake handle is brought up to a position convenient to the operator's left hand. This neat arrangement improves the performance since the operator has an unobstructed view of the tracks and does not have to get in and out of the cab to lock the turntable.

One-Wire Electrical System

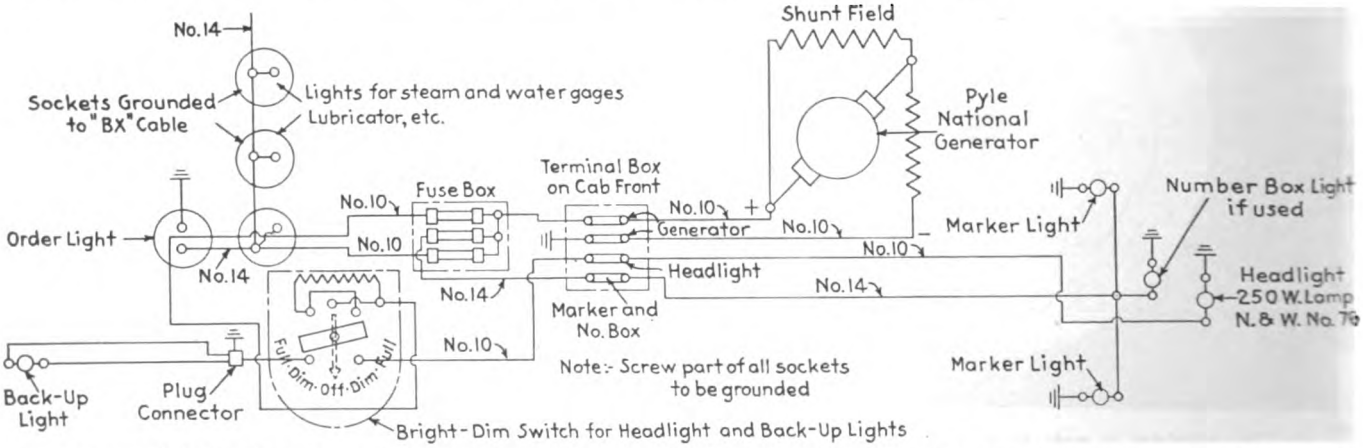
The Norfolk & Western has decided to adopt a grounded one-wire system for the electric wiring on steam locomotives. This will be applied to new locomotives being built and existing locomotives that need rewiring. It will not be used on locomotives equipped with cab signals as the I. C. C. requires an insulation resistance of one megohm between the wiring and ground. The single wire grounded system was adopted because of the conservation of critical materials it effects (rubber and copper) and for the simplification of the wiring.

No change has been made in the conduit arrangement. The insulated wire is the same size as formerly used with the two-wire system, namely, No. 10 rubber-covered wire for the headlight and back-up light, and No. 14 rubber-covered wire for cab lights, markers, etc. One side of the generator is grounded in the cab junction box. It was considered best to place the ground at that point rather than at the generator so that there would be no confusion if generators were interchanged between grounded and non-grounded systems.

In the cab fittings which support the flexible conduit drops to the various gage lights, the hot side of the line is connected to both of the contacts. In the fitting attached to the drop cord, the single wire is connected to only one contact of the cap. This insures anchorage to the lamp regardless of which way the cap may be attached to the base. Connection to a single contact in the cap insures against having a short circuit in case drops are transferred from a locomotive with a grounded wiring system to one having an all-insulated system.

It may be noted from the diagram that the receptacle on the back of the cab for the back-up light connection is grounded and that a two-wire system is used from there on to the back-up light. This was done in the interest of avoiding confusion or trouble in case a tender should be switched from a locomotive with a grounded system to one with a non-grounded system.

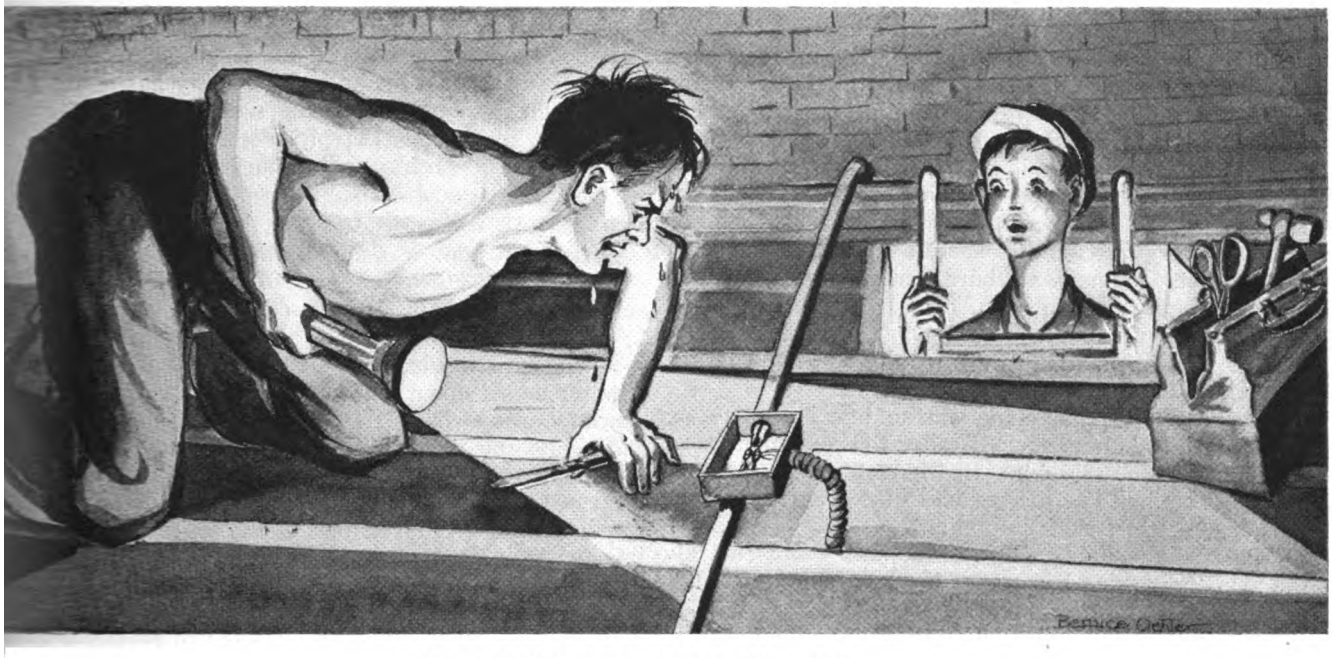
Since it is proposed to wire all new locomotives with a grounded system and to do likewise with existing locomotives which need rewiring, it will be necessary to maintain the double conductor to the rear headlight during the period of transition from the fully insulated to the grounded system.



One-wire grounded electrical system designed to be used on all N orfolk & Western locomotives except those equipped with cab signals

Cooling Off Period

By Walt Wyre



"The chief clerk wants to see you right away."

THE division office building of the S. P. & W. at Plainlle was originally a hotel and eating house. The buildg was remodeled in the depression days when railroads uld scarcely afford enough red ink for accounting. The ove was motivated by economy and the job was done cheaply as possible. When Ned Sparks, the electrician the job, suggested renewing all of the wiring, the idea as vetoed emphatically. Not only did the powers that ntrolled the purse strings refuse to go along with reiring, Sparks was told to use only second-hand material r any additional lights required in the office.

When the job was finished, Sparks wasn't proud of hat he had done. In fact, he was somewhat surprised hen all the lights burned and fuses didn't blow. After bout two years, with very little trouble, the electrician ad decided perhaps it was a pretty fair job after all, unil one day in August. It was so hot that day the merury didn't have energy enough to climb high as it should ave. One boilermaker working on a side sheet claimed e had to lay rivets in the shade to keep them from getng too hot, and Sparks working on a welder in the electric shop wouldn't have argued with the boilermaker.

Sparks was wiping perspiration with one hand and tarting a brushholder screw with the other, when a water ervice man came in with the threadbare question, "Is it hot enough for you?"

"Just about," Sparks replied. "There's only one place hotter than this tin barn and besides the heat, I'm afraid I wouldn't like the company there."

"Yeah, Hilter and his stooges are not going to improve the place when they get there either, and speaking of hell, the boiler feed pump motor is that hot," the water service man said.

"Is it still running?" Sparks asked.

"It was when I left, but it was hot enough to roast a 'wieny'."

"I'll look at it." Sparks mopped his forehead with a piece of waste and picked up some tools and a combination volt-ammeter.

THERE wasn't any doubt about the motor being hot. The characteristic odor that filled the boilerroom was evidence enough. Sparks checked the voltage and found it good on all three phases. He then checked the current and found it to be just slightly above the rating shown on the motor name-plate, not enough to cause heating.

"Is this place closed up all of the time?" Sparks asked the water service man.

"Yes, most of the time. The fuel foreman comes by about twice a day to see if the automatic controls are working properly."

"Well, no wonder the motor is hot!" Sparks commented. "It's like an oven in here and the motor setting right there between the boiler and wall hasn't a chance to

get any air. If I can find a nail bar, I'll pry a section of iron off and make an opening near the motor so it can get a little air."

A bar was found and a section of the old metal roofing with which the boilerroom was sided was removed, making an opening about two feet wide and three feet long near the motor. "Better tell one of the B&B men to make a louver shutter," Sparks suggested.

"What kind of shutter?" the water service man asked.

"One with slats slanted so air can get in and rain can't," Sparks explained.

"O. K.," the water service man said, "I'll tell the B&B foreman."

Sparks had shut off the motor to allow it a chance to cool off a little, but water was getting low in the gage, so he closed the switch. He watched the motor a few minutes, then satisfied that it was running cooler, gathered up his tools and went back to the electric shop.

Jim Evans, the roundhouse foreman, was waiting in the electric shop. "I've been looking everywhere for you," Evans said. "The superintendent's chief clerk has been phoning every five minutes about some electrical trouble in the office. Lights won't burn, but worst of all, the air conditioning outfit won't run."

"I've been up to the boilerroom," Sparks explained. "Guess I had better rush down to the office and fan the chief clerk unless I can get the cooler going."

Dan Smart, the chief clerk, was hot as a peanut roaster at a Fourth of July picnic. "I called the roundhouse over an hour ago," he said when Sparks entered.

"What seems to be the trouble?" the electrician asked, ignoring the chief clerk's outburst.

"Everything—lights won't burn, fans won't run, and the air conditioning has stopped. How long will it take to fix them?"

"Well," Sparks replied, purposely deliberate, "that depends on what the trouble is and how long it takes to find it. Might locate the trouble and correct it in just a few minutes, and again it might take several hours or even days, but I'll see."

The chief clerk swelled up like a toad with a fill of bugs. Sparks left before Smart could think of an appropriate remark and went upstairs where the entrance switch and fuse cabinet were located. He found one of the 60-amp. main fuses blown. When another fuse was put in, the lights came on. Sparks closed the switch box and started down the steps when out went the lights again. Almost immediately there was the sound of some one coming up the steps.

It was Dan Smart. "You had them on once, why didn't you leave them on?" he wanted to know.

"There was just a little current left in the wires," Sparks explained without cracking a smile. "When it drained out, there wasn't any more."

Smart stamped down stairs, and Sparks started trying to locate the trouble.

It didn't take long to find which circuit, or rather circuits, were causing the main fuse to blow. There was a penny under one of the fuse plugs in the lighting circuit to the main office and a nickel under one of the plugs of the circuit to the super's private office and that of the chief clerk. The fan motor for the evaporative cooler was on that circuit also, Sparks remembered.

When the six cents change was safely in his pocket, Sparks screwed 15-amp. fuse plugs in the receptacles and replaced the blown 60-amp. main fuse. One of the 15-amp. plugs went out immediately when the main switch was closed.

The next forty-five minutes was spent disconnecting drop cords, extension plugs, and the cooler fan m None of these was shorted and it didn't require a c ball to tell that the trouble was somewhere in the duit between the fuse cabinet and the last outlet. question was—where.

"Have you found the trouble yet?" the chief asked when Sparks started to leave.

"Not exactly, I've got to go to the roundhouse a ringer to locate the trouble."

In about fifteen minutes Sparks returned carry magneto ringer. He located a ladder and climbed u the attic. The electric shop was hot, the attic was h and besides the air was so stale Sparks felt like he n oxygen to stay up there. He worked, sweated, and s If he stood up he bumped his head, when he kne ceiling joists hurt his knees. The only position in w he could work was squatting with a flashlight cla between his knees. Perspiration streaming throug dust left trails on his forehead and stung his eyes.

About an hour was all Sparks could stand the to in the attic. He came down for a drink of water a breath of fresh air. It had seemed warm in the hal when Sparks went up in the attic, but when he came d it felt like a sea breeze by comparison. After a drin water he sat down in an open window and lighted a arette. Somewhat refreshed, Sparks climbed up the der into the steaming attic. He squatted down ov junction box on that run of conduit that he had opened. He disconnected the wires and tested. T was a dead ground in one of the wires and it was somewhere ahead of where he was testing. Sparks twi the wires together again, held a lighted match to twisted wires to melt and fuse the solder on them started taping the joint. He started to replace the ju tion box cover when he noticed that one of the w showed signs of having been hot at some time. The sulation was rough and wrinkled.

Sparks replaced the cover on the junction box started to the next and last box.

"Hey, electrician!" some one yelled from below.

"Yeah," Sparks replied. "I'm up in the attic."

The errand boy from the office climbed up the lad and stuck his head up in the attic. "The chief clerk wa to see you right away," the boy said.

"O. K., I'll be down in just a few minutes," Spa replied.

The electrician knew before he opened the last b that chances of the grounds being in the conduit w slim. In fact, the idea that the trouble was somewhere the conduit concealed in the walls had already occurr to him. Tests showed the surmise was correct. Wh the building was being remodeled, several junction box were covered, which made it impossible to pull the wir out without removing sections of the wall. Sparks h mentioned it at the time as an argument in favor of r wiring the building, but no one else seemed concerned.

"If Dan Smart has an idea of bawling me out, it's poor time to start." Sparks said to the office boy whe the two started down the steps.

"I don't know what he wants," the boy said, "but h seemed in a hurry about something."

"The pump motor at Middleton is burned out," th chief clerk told Sparks. "Did you locate the troubl here?" he asked almost in the same breath.

"Well, yes and no. I located the trouble, two wires ar grounded somewhere in the wall."

"Does that mean the wall will have to be torn out?"

the clerk inquired of Sparks in a very anxious voice.

"Either that or running a new line on the outside," Sparks said. "It's a pretty fair sized job in either case."

"You couldn't get it done before the Limited leaves?" Smart was beginning to worry.

"Not hardly," Sparks told him. "It would take at least a day. It's 3:45 now, the Limited leaves at 8:15. I'll not much more than have time to get a motor ready, get tools together, operate an air compressor."

There was a ten horsepower, 1160 r.p.m. motor in the electric shop. Sparks wasn't certain of the shaft size of the motor at Middleton nor the diameter of the pulley, which didn't make a lot of difference because the only pulley he could find that would fit the motor was one six inches in diameter with grooves for five B size vee belts.

THE Limited was nearly two hours late leaving Plainville and pulled into Middleton at 1:35 a. m. Middleton is one of the few towns that has no defense plants or army posts. When Sparks climbed from the crowded coach where he had stood since leaving Plainville, the only person on the platform was the night operator. Sparks helped unload the motor, his tool box, and some express.

"Ben Burns, the water service man from Sanford, is up at the hotel," the operator told Sparks. "He said for me to call him when you got here."

"Does he want to work on it tonight?" Sparks asked.

"Yes, there isn't enough water left in the tank to supply drinking water in the section houses and depot," the operator said.

Sparks walked the four blocks to town looking for a cup of coffee, but the two cafes were both closed. When he returned, Burns was waiting at the pump house.

"How did you get down here from the hotel so quick?" Sparks asked.

"Drove down," Burns said. "I came over from Middleton this morning in our water service truck. I looked at the motor and the winding was charred and knew right away another motor was all that would do any good here."

"Well, if you've looked at it, I'll take your word," the electrician said. "Guess we might as well get the motor down here from the station."

The ten horsepower motor was too heavy for the two men to lift off the baggage truck. They searched around and found a grain door and slid the motor down on it. When the crate was removed, Sparks asked Ben if he had a rule.

He measured the distance between holes on both motors and shook his head.

"Won't it fit on the base?" Burns asked.

"No," Sparks replied. "Lacks nearly an inch one way and two inches the other."

"Maybe we can find a couple of timbers and bolt them to the motor base and fasten the motor to them," the water service man suggested.

"Well," Sparks agreed, "if we can find suitable timbers and bolts, it might work O. K."

Perhaps suitable timbers might have been found in day-time, but the two men failed to find any that night.

"We might find something in the section gang's tool house," Sparks suggested. "Have you got a key?"

"Yes, I think so," Burns said. "We'll take a look."

Spikes, tie plates, a miscellaneous assortment of bolts, and a pile of fish plates was all that was found in the tool house. They closed the door and started to go back to the pump house when Sparks decided to look in the scrap box back of the tool house.

"Say, you've got a cutting torch in the water service truck, haven't you?" Sparks asked.

"Yeah, why—have you found something?"

"Well, I'm not sure," Sparks picked up a piece of flat iron four inches wide, half an inch thick and between three and four feet long. "Why can't we burn holes in this to fit the motor base, then burn some more holes to fit the motor."

"Looks O. K.," Burns agreed. "Let me have one end and I'll help you carry it to the pump house."

It was just a matter of minutes to burn the iron in half, then make holes to fit the motor base. The two men dragged the motor to the base and started to set it on the iron when they saw that the bolts projecting through from the base wouldn't allow the motor to set on the iron. They stood looking at the motor and base. Suddenly Burns had an idea.

"I noticed some 5/8 by 4 machine bolts in the tool house," Burns said.

"How can we use them?" Sparks interrupted.

"Well," Burns continued, "I figured we can weld the 5/8th bolts on top of the iron pieces, then cut off short pieces of pipe and slip over the bolts, then a washer on top of the pieces of pipe will hold the motor clear of the base bolts."

"I believe you've got something!" Sparks agreed.

It required about an hour to weld the bolts to the iron and cut pieces of 1/4 pipe of suitable lengths to slip over them. Then, after considerable tugging and straining, the motor was set on the bolts and nuts screwed on to hold.

"Say, there's something wrong here," Burns said. "The bolts are way too loose. I see what it is, the pulley on the motor you brought is two inches smaller than the one on the other motor. We can set the motor back on the base to tighten the belts, but I wonder what difference it will make with the air compressor?"

"Well," Sparks said, "it will run about three-fourths as fast as before, but I don't know whether it will furnish enough air for pumping or not. We'll have to just try it and see."

When the bolts were tightened in place, Sparks closed the switch and the motor started. In about five minutes water started gurgling in the well.

"Looks O. K.," the water service man said. "I'll tell the operator to start the three-horse motor to pump into the supply tank in about an hour. Let's go to bed! I'll leave word for the agent to call us if it doesn't work O. K."

IT was nearly seven o'clock when the two men went to bed. They slept until about eleven when the heat awoke them. When they had eaten, they went to the pump house to see how the motor was getting along.

"It's doing better than it ever did," Burns said. "The air-lift always pumped more than three-horse pump before and the sump ran over. They are pumping about the same now and the ten-horse motor is not getting hot like it did. This is the third motor to burn out here this summer."

Sparks checked the current to the motor and found it to be just barely over 24 amperes. "Yes, according to the load now, the motor would be sufficiently overloaded with the eight-inch pulley to cause it to heat considerably. Seems like all I've been doing lately is cooling off things. Wish I had something to cool me off right now."

"Me too," Burns said. "Let's go see if we can't find a couple."

Air Filters

What suggestions can you make for getting best performance out of air-conditioning filters particularly with reference to present day operating conditions?

Know Your Dust

For satisfactory filtration of air on air conditioned railroad equipment the filters first should be properly selected or engineered for the particular type of service in which to be used and then filters should be handled properly to insure the efficiency as designed.

There is a wide variation in the analysis of dust according to the geographical territory of operation, season of year and type of motive power used. The operation of trains with Diesel and electric power presents a different problem in fresh air filters than that for coal fired steam power. There is one element in dust which is common to operation with all types of motive power, namely, the very finely divided dust which will pass through a 200 mesh screen. This very fine dust has practically no mass or weight and is carried through the filter in normal flow of air unless the design of filter incorporates necessary features to hold this type of dust.

For operation with coal fired power, particularly in these times, with heavy trains the stack discharge losses are much greater than normally which greatly increases the dust content of the air surrounding the train and supplied to the fresh air filter. With coal fired power the filter is subjected to much wider range in sizes of dust. The dust to filter may range from 40 to 200 mesh sizes including cinders to the talc-like fly ash.

An important detail to consider in fresh air filters, particularly the oil-dipped impingement type, is that the air velocity through filter is set at the manufacturer's recommended velocity. The efficiency of the filter is directly proportional to the air velocity up to the maximum specified by the manufacturer. Conversely, excessively high air velocity through a filter will reduce the filter efficiency.

In such installations where separate recirculated air filters are used a design of filter best suited for its application should be used. On cars where lint condition is bad, such as on diners, the filters should be designed for lint holding capacity with minimum reduction in air resistance. The design of filter should also provide features in construction for simple process to remove lint in ordinary filter washing operation. The plugging of lint in recirculated air filters will overload the fresh air filter, reducing filter efficiency and reduce total conditioned air to the car.

The dust holding capacity of filters should be carefully considered when setting the time between filter cleaning and replacement. When a filter is loaded with dust to its rated capacity, additional service will allow air to pass through filter without filteration. The service period for filters may range from 3 to 30 days, according to the conditions of operation. For an oil-dipped metallic filter it must be considered that the filter functions only as long as there is an oil film to hold dust. A dry filter does not hold dust.

The cleaning and oiling of filters is important for the efficient performance of the filter. The filter should be thoroughly cleaned of all dust and oil, then dried and dipped in a suitable grade of oil. The draining of the excess oil from filter is another important operation for satisfactory filter performance. The filter should be dipped in an oil of such viscosity that a firm uniform coating of oil is provided for all surfaces of the filter media. The viscosity to be heavy enough so that oil will not drain from filter when in service position. Normally two grades of oil are sufficient for summer and winter operation with a mixture of the two grades for the transition seasons.

In these times it is difficult to consider small details but it is often found that the efficiency of the filter is often criticized when by-passing of unfiltered air is the primary cause of the trouble. Careful attention should be given to the maintenance of an air-tight seal between the filter and the filter frame. The plenum chamber is normally operated under a partial vacuum which requires maintenance of an air tight chamber to insure passage of all air supplied through the filters.

The proper attention to air filters to provide most satisfactory possible performance will result in better performance of the air-conditioning apparatus and require less frequent interior cleaning of cars.

AIR CONDITIONING ENGINEER.

* * *

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York.

How can a group of unit heaters be controlled to meet the requirements of heating an enginehouse?



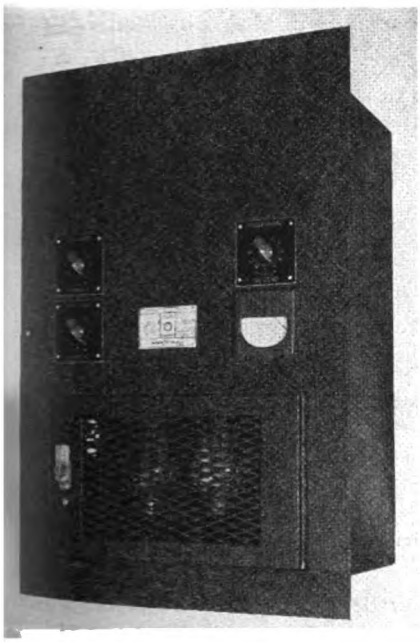
Equipment used by one railroad for cleaning, drying, dipping and draining air filters

NEW DEVICES

Electronic Furnace Control

Because resistance furnace temperatures are apt to vary, engineers of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., have developed the Furnatron control system to keep such variations to a minimum. This is accomplished through combining a suitable thermocouple type of temperature controller with automatic electronic control of the saturation current of a saturable reactor connected in the supply line of the furnace elements, thus automatically controlling the power input into the furnace.

The Furnatron system may be used for furnace temperature regulation and control of a single- or three-phase furnace. Where the line or furnace transformer voltage is not suitable to supply a.c. to the thyratron tubes, an anode transformer is furnished. The droop corrector, another optional feature, is included for installations where the rate of material flowing through the furnace changes, thus compensating for heat ex-



The Westinghouse Furnatron control is designed to keep furnace temperatures within narrow limits

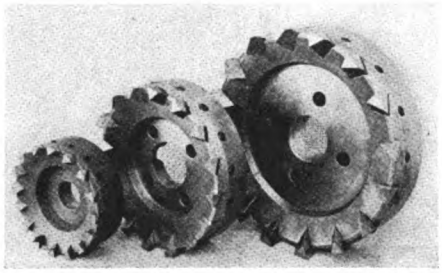
change due to fluctuations in the rate at which the furnace is being loaded.

The control also includes a compensator for line voltage variations, since in some cases the power dissipated is roughly proportional to the third power of line voltage, and variations in such voltage greatly affect the operation of a furnace. The compensator practically eliminates the effect of fluctuating line voltage which is especially important on high thermal inertia furnaces. The complete furnace regulator control is built for flush panel mounting.

The installation is guarded by protective devices which include a time delay relay, over-temperature mechanisms, surge suppressors, fuses and suitable disconnecting devices.

Cutter Blades For Face Milling

Triangular-shaped adjustable tool bits for face milling are being manufactured by Weddell Tools, Inc., Rochester, N. Y. These bits are locked home in vee-shaped holes in the cutter body by lock screws. The cutter body is tied together all around



Triangular-shaped tool bits in this cutter body are fastened in place by lock screws

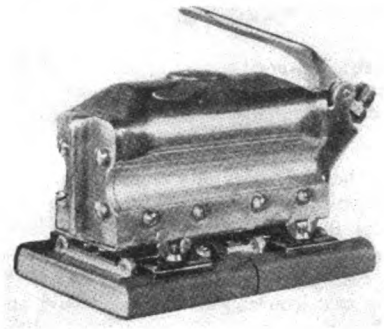
the blade without slots. Each bit is backed up by an adjusting screw which permits close adjustments on the cutter blade up to 60 per cent of its length. No wedges are required. The triangular shape of the bits offers better chip clearance because there is no heel on the blade to catch or clog chips. The face of the cutter body is dished out to add to chip space which expands in size away from the cutting edge in the direction of the chip flow.

These face mills are made in three different sizes for cuts up to ¼-in., ½ in., and ¾ in. in depth. Cutters are made of high-speed steel, cast alloys or carbide-tipped triangular bits. They can be furnished to standard or special specifications, with any number of bits, set at the required cutting angle for any materials.

High-Speed Hand Sander

Designed and built for all practical hand sanding and finishing operations, the non-vibrating sander, manufactured by Sundstrand Machine Tool Company, Rockford, Ill., is now available in a lightweight, high-speed Model 1000. This smaller and lighter machine weighs less than 6 lb., has a speed of 3,500 oscillations per min., can be equipped with different types of sandpaper attachments for large or small, wide or narrow, flat or curved surfaces on metal, wood, plastics, or composition.

Operation of the machine is obtained with pad movements started and controlled by a palm lever fitted at top of the machine



High-speed hand sander with moving parts balanced to eliminate vibration

housing. No turning of "on" or "off" switches is required. When the machine is gripped to operate, the reciprocating action of pads starts. Upon release, the machine automatically stops.

This sander is said to be free from vibration. Opposed-pad action and balance of moving parts are designed to eliminate all vibration and improve the qualities and uniformity of the finished product. Elimination of vibration reduces fatigue and increases the efficiency of the operator.

Uniformity of the stroke and the high speed of the reciprocating pads materially increase the life of abrasive paper by keeping the paper surface substantially free from material particles.

D. C. Vertical Motors

A line of direct-current vertical motors ranging from 40 to 200 hp. at 1,750 r.p.m., and in equivalent ratings at other speeds, has been announced by the General Electric Company, Schenectady, N. Y. The new motors, which are furnished for both constant and adjustable speeds, are designed for low-thrust, solid-shaft applications on pumps, machine tools, and marine under-deck auxiliaries. They are also desirable in cases where valuable floor space must be saved or the expense of gearing avoided.

The motors are drip-proof, protected construction, providing complete protection from dripping liquids and falling objects. convenient fittings on both the upper and



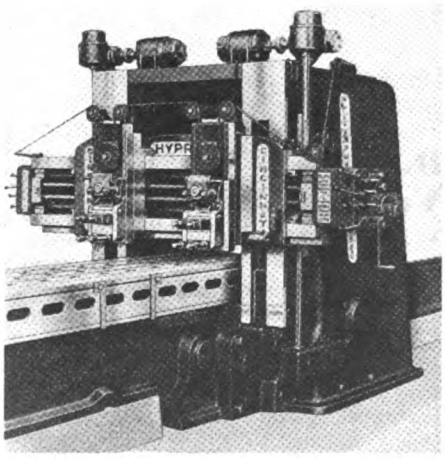
Vertical, drip-proof, semi-enclosed, grease-lubricated, ball-bearing, shunt-wound, 230-volt, d.c. motor rated 40 to 60 hp. at 515 to 690 r.p.m.

lower bearings simplify lubrication, and provision for the escape of excessive grease reduces the possibility of over-lubrication. A special bearing housing prevents grease from entering the motor.

The cast-iron conduit box is roomy and can be arranged for bringing the leads in at the top, bottom, or either side. Two hand-hole covers, removable without the use of tools, permit quick and easy inspection of the commutator end brushes. The ring-type base has an accurately machined rabbet and jig-drilled mounting holes, assuring permanent alignment with the driven machine. Sturdy lifting lugs facilitate installation.

Frog and Switch Planer

An improved frog and switch planer designed for high production with the greatest possible rigidity in withstanding heavy cuts has been announced by the Cincinnati Planer Company, Cincinnati, Ohio, for fall deliveries. It has a double-length enclosed bed with a deep housing cheek bearing to the bed. A full-depth box section arch adds to the rigidity of the housings. A wider vee spread to the bed and table is provided. The table is of greater depth than in previous models and has full length hold-down gibs.



Heavy-duty planer for frog and switch work

A combination herringbone balanced drive is designed to run efficiently and smoothly under the heaviest cuts and it is built for 100 hp. operation. All shafts are of large diameter with hardened, ground and lapped journals. All gears are of steel and hardened. Heavy-wall bronze bushings are used throughout the drive train. Tool blocks, clapper boxes, and clamps are of steel. A Hypro tool-block abutment relieves strain from the clapper-box pin. A self-locking worm is used to swivel the clapper box.

The rail and down-feed screws are of extra large diameter. A long bronze nut is mounted near the top of the slide accessible for easy replacement. There is provision for takeup of backlash in the double bronze saddle nuts. Counterbalanced inverted dovetail slides prevent dropping of the slide and consequent hammering of the screw in the nut as the tool strikes the cut. The rail heads are mounted on a square gibbed narrow guide cross rail.

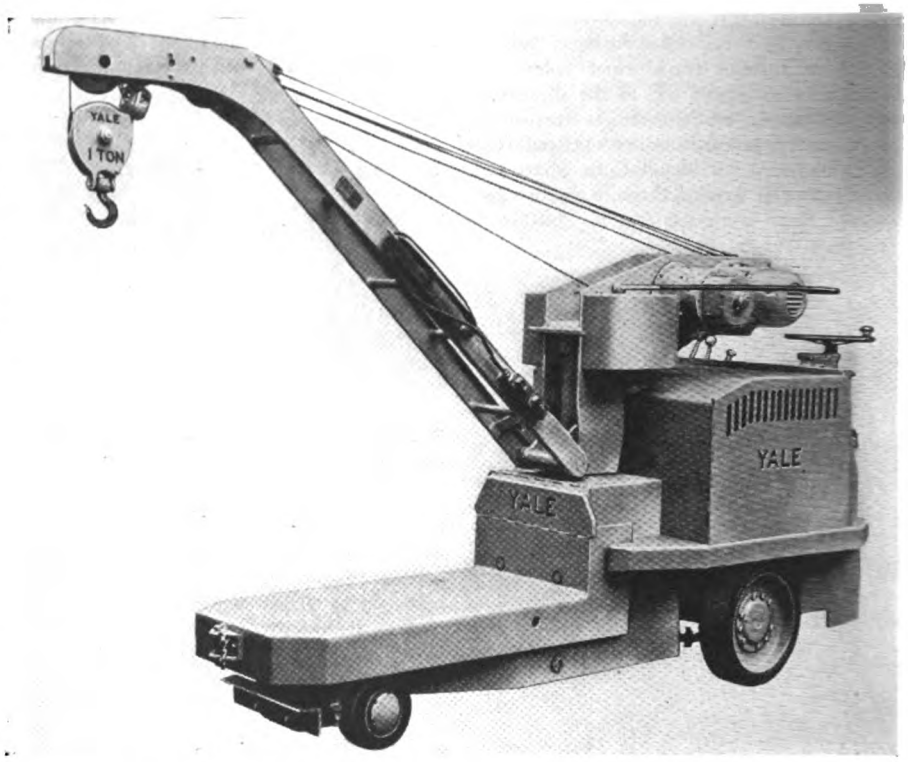
A feed and traverse sealed unit with hardened gears and clutches with all shafts mounted in antifriction bearings running in a bath of oil gives convenience and flexibility to the directional-controlled-traverse and feed.

Instantaneous rail lift is optional equipment. Heads and slides can be fed and traversed in any direction, independently or together. There is a special jigging device for feeding the tool into the work for tapering and trimming as the table moves in the cut direction. Both heads may be moved manually in either the same or opposite directions simultaneously, with a single crank.

The machine was developed in cooperation with frog, switch and crossing manufacturers and is said to be designed not only with consideration for rigidity, weight, speed and accuracy but also for convenience and safety to the operator.

Platform Crane Truck

A multiple-purpose industrial truck for shop use is being built by the Yale and Towne Manufacturing Company, Philadelphia, Pa. It combines a 6,000-lb. capacity low elevating platform truck with a 2,000-lb. capacity twin-unit crane. Electrically powered with four speeds forward, and a reverse, the unit is compact and is designed with small overall dimensions to permit maneuverability in close quarters.



Crane truck with an elevating platform which fills many shop needs

A Yale Cable King winch unit supplies the hoisting and booming power and both can be operated simultaneously through separate push-button crane and hoist control. Separate independent motors and power units drive the truck for travel and to hoist and boom loads. Slewing is controlled by hand. Loads can be picked up and placed upon the platform of the truck or carried on the boom to be placed where needed. When desired the truck can be used for the moving of skids by means of the elevating platform.

CHILLED CAR WHEELS *are practically indestructible!*



When Chilled Car Wheels reach a certain wear-point, they are sent back to our foundries, under our wheel exchange plan, and speedily recast into new wheels with the addition of only 11.22 per cent new pig-iron! Under this wheel exchange plan, the railroads receive new wheels for old on a conversion charge basis. Thus Chilled Car Wheels are practically indestructible, as they can be recast and reused over and over again.

With 38 plants strategically located in the United States and 8 in Canada, quick delivery of new wheels in exchange for old is assured, as are low delivery costs.

1942 CHILLED CAR WHEEL PRODUCTION:

2,682,000 Chilled Car Wheels were delivered in 1942.
885,020 Tons of metal were used to make them.
Of these:
782,181 Tons or 88.38% were scrapped wheels.
99,299 Tons or 11.22% were new pig-iron*.
3,540 Tons or .40% were alloys.
This *IS* Salvaging Scrap for the War Effort!

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3350

High Spots in

Railway Affairs . . .

Wartime Passenger Traffic

It is reported that one railway executive, at least, has said that on the basis of recent experiences it would appear that the best way to attract passenger traffic is to conduct a publicity campaign suggesting that the public refrain from unnecessary travel during the war emergency. The appeals of the O. D. T. and the railroads, however, were apparently effective over the Labor Day week-end, for it was reported that there was less traffic than a year ago. Since the middle of July the Southern Pacific has required travel reservations. This has eliminated crowding and standing and is said to have a tendency to spread traffic more evenly throughout the week. It has also "relieved congestion at the larger terminals, since passengers don't come to the stations unless they have obtained space in advance." One road operating out of Chicago posts a "standing room only" sign as soon as the seats of certain trains are filled.

Staggering Traffic

The Bureau of Railway Economics, according to a statement made by Caleb R. Megee, manager of the Open Car Section of the Car Service Division of the A.A.R., before the Southeast Shippers' Advisory Board, estimates that during the year 1943 the railways will carry, measured by ton-miles, more freight traffic than they did in 1918, the peak year of the first World War, plus 1939, the last year of peace.

Jeffers Makes a Record

There is always the danger, when a business or professional man enters public life, that politicians will get the best of him, or at least embarrass him and discredit his performance. Not a few such men have been drafted for public service in the war emergency, at great cost and inconvenience to themselves, but have eventually retired to private life in disgust. Not so with William M. Jeffers, president of the Union Pacific, who was drafted at a critical time (September, 1942) for the difficult position of rubber director for the War Production Board. Chairman Donald M. Nelson characterized it as one of the toughest assignments of the war program. Mr. Jeffers resigned the position early in September because "the big job covered by the recommendations of the Baruch report is done" and "the greatest contribution I can make in the present emergency is to return to an on-the-job handling of the operations of the Union Pacific." The Pittsburgh (Pa.) Post-Gazette made this comment: "The ruffled tempers and broken precedents of Mr. Jeffers' passage through the red-tape of Washington made news copy of a most exhilarating and welcome sort. His record vindicates again our belief that American business and executive talent has an effective role to perform in the management of national affairs."

Narrow Gage Line Converted

The narrow gage lines, familiar to many of the older mechanical department employees who worked on the dinky little locomotives when starting their careers, are passing out of existence in this country. At one time the Colorado & Southern 3-ft. gage system included 384 miles. On August 25 the last of this narrow gage mileage, extending from Leadville, Colo., to Climax, 14.06 miles long, was discontinued and replaced by standard gage. The life of the narrow gage line was shortened because the operations of the Climax Molybdenum mine, on the Continental Divide at Climax, have been so greatly increased during the war, that it was necessary to enlarge the railroad facilities. Work on the change-over began last spring, when work was started on replacing the shorter ties with those of greater length. Eventually rail was laid on each side of the narrow gage rails and the necessary ditching and bank widening work was done. The final change from narrow to standard gage operation was, therefore, handled expeditiously within a 24-hour period. The old, narrow gage cars and locomotives have been sold and part of the equipment will be used on narrow gage lines in Alaska and Hawaii. The old C. & S. narrow gage line has thus, in a sense, "gone to war."

Preparing for the Future

Some of the discoveries and developments in the designing and production of war equipment promise to have a profound effect on our civilian life when peace comes. Many of these discoveries and developments in research laboratories and the new methods inaugurated in the production processes, have been most fruitful and sound almost like fairy tales. Obviously, for strategic reasons, many of them have not been announced or publicized.

It is obvious that we must reduce the costs of production and provide for a low cost, widespread distribution of products if we are to overcome successfully the heavy handicap of colossal war debt and meet other compelling obligations that will face us in the post-war era. The railroads will have a large part to play in the reconstruction period and, let us hope, in the future life of the nation. They have demonstrated their ability and capacity to handle mass transportation under unusual handicaps and undoubtedly have learned many lessons that can be applied to advantage after the war. They will continue to be the backbone of transportation in the days to come, despite the predictions of a considerable number of enthusiasts for other types of transportation.

That the railroads are awake to the seriousness of the problems that will confront them and to the necessity for planning well and carefully to meet competition in various forms, is indicated by the comprehensive plan of research that has been set up by the Association of American Railroads, under the direction of Vice-President R. V. Fletcher, and by the excellent research programs that are being quietly followed out by a number of the individual railway systems. One thing is certain as the picture gradually unfolds with the progress of these various research groups, and that is, that the railroads cannot be accused of being asleep at the switch, but are doing their level best to fit their programs into the post-war program, which, if our country is to continue to progress, must lick the problem of unemployment and insure a wider distribution of our products and services.

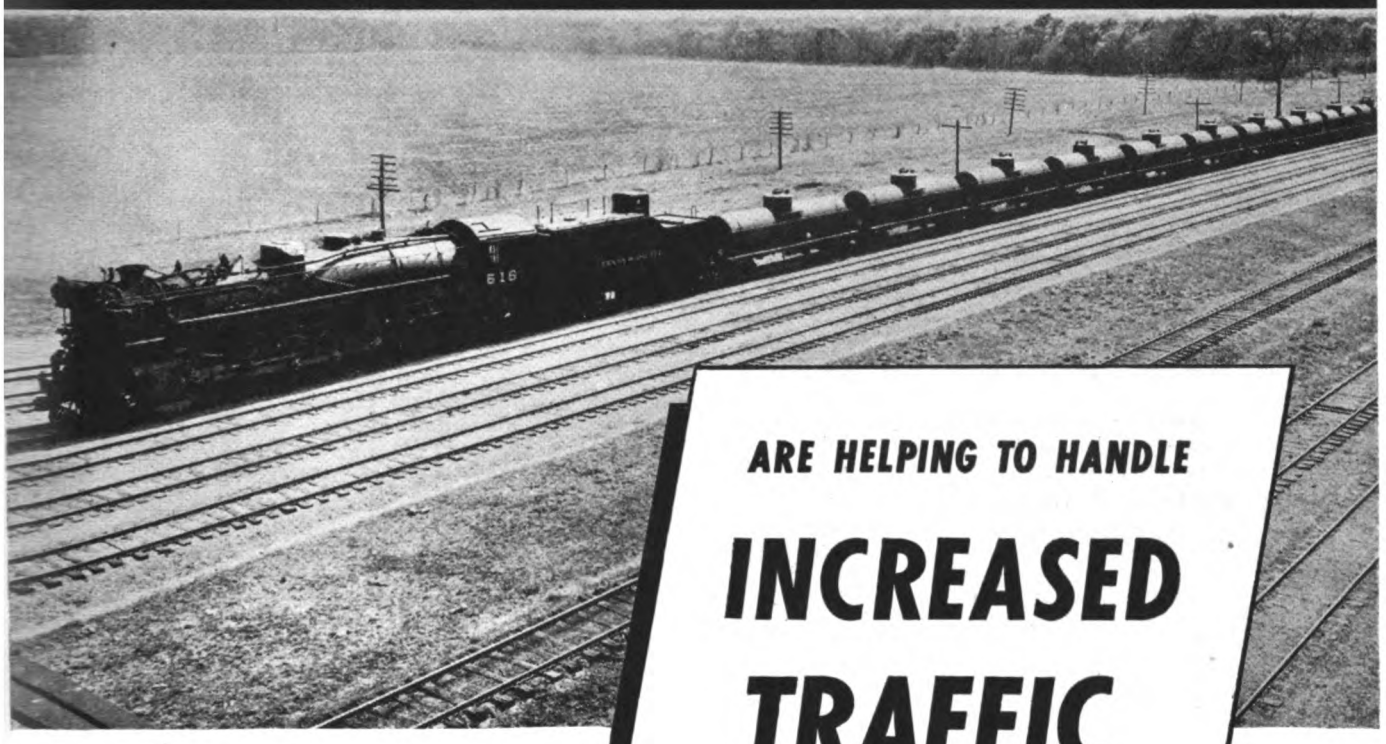
One of the best recent statements of railroad research is that made by E. C. Nickerson, assistant manager, sales and service, New York, New Haven & Hartford, in the Railway Age of September 11. The set-up of the New York Central Research Council was described in the Railway Age of July 10 by R. E. Dougherty, vice-president, improvements and developments, of that system.

Oil Transport

Early in September Director Eastman, of the ODT, pointed out that "we are approaching a time when our rail, water and pipe line facilities and equipment will be adequate to transport all the petroleum products which may be expected to become available for movement." The spectacular record made by the railroads in handling tank cars and the completion of the "Big Inch" pipe line, together with other measures, finally did the job. "Even now," said Mr. Eastman, "supplies are not always at hand at some important shipping points to keep these facilities operating at full capacity." This does not mean, however, that the railroads can let down on their efforts. Mr. Eastman, in closing, sounded this warning, "It is still imperative that there be no relaxation of efforts to eliminate all unnecessary tank car detentions, to move tank cars—both loads and empties—as rapidly as possible, and use all our petroleum transport facilities with the utmost efficiency."

(*Turn to next left-hand page*)

LIMA LOCOMOTIVES



ARE HELPING TO HANDLE

INCREASED TRAFFIC

THE Texas and Pacific Ry. Co. serves an area of prime importance in the war effort. » » In 1942 the revenue freight handled was 60.12% over 1941 and ton miles were up 35.58%. » » Thanks to a progressive motive power policy there were available to handle this tremendous load a group of modern Lima-built locomotives that contributed substantially in moving the increased tonnage.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED INCORPORATED, LIMA, OHIO

NEWS

Adjusting Safety Goggles

A SHORT sound motion picture film entitled "Right on the Nose" has been produced for the American Optical Co., Southbridge, Mass., and is available for loan or purchase through the company. It shows in detail the quickest, easiest methods of adjusting non-prescription industrial safety goggles and is intended to help eliminate the tendency of workers to discard improperly fitted goggles because they are uncomfortable to wear. The film demonstrates graphically that properly fitted goggles are light, cool and comfortable to wear and points out the relatively simple steps required to adjust goggles to faces of different sizes and shapes.

A companion booklet of the same title has also been issued.

A. A. R. Mechanical Division

LETTER BALLOT RESULT

THE General committee of the A. A. R. Mechanical division authorized the submission of recommendations from the Committee on Tank Cars to the letter ballot, these recommendations covering revised definitions and designating letters for Class T tank cars, as described in circular letter D. V.-1050 dated August 14, 1943. All of the propositions contained in the letter ballot have been carried by a large majority and include the revision of definitions TA, TG, TL, TM, TMU, TP, TW, also revisions of Note No. 1 and of the supplementary table. The following definitions are eliminated, TGB, TMM and TR. The recommendations of the Committee on Tank Cars regarding revised definitions and designating letters have been approved by the A. A. R. effective immediately.

SUBSTITUTION OF ONE-WEAR STEEL WHEELS SHOWN BY STENCIL

Under date of September 9, the A. A. R. Mechanical division has sent a circular letter to members and private tank car owners referring to the application of one-wear wrought-steel wheels (preferably new) in replacement of defective cast-iron wheels, without penalty, irrespective of owners or handling line defects, the car owners being billed for the betterment in accordance with the allowances shown in the interchange rules.

The letter states that questions have been raised with respect to the omission of stenciling to protect substitution of one-wear wrought-steel wheels in such cases and that, to clarify the intent, the following note has been added to first paragraph under Sec. D of the letters listing car owners who have authorized the railroads to substitute steel wheels: Note.—When one-wear wrought-steel wheels are substituted for cast-iron wheels, proper stenciling to protect the application must be applied to the car, for which a charge of ½ hour may be made. Such stenciling should be applied on the tank heads at both ends of car and read "1-W WRT. STL. WHLS. R&LI" (or whatever location or locations are involved).

GEARED HAND BRAKES

Following the adoption of Specifications for Geared Hand Brakes by A. A. R. Mechanical Division letter ballot last year, the various manufacturers of geared hand brakes were invited to submit their brakes for test and make application for certificate of approval. The secretary's office announces that, as of August 14, applications have been received, satisfactory tests conducted and certificates of approval awarded by the Committee on Geared Hand Brakes to the following manufacturers: Ajax Hand Brake Company, Type Designation Drawing 14038; Champion Brake Corporation, Drawing 1148; Champion Brake Corporation, Drawing 1124; W. H. Miner, Inc., Pattern D-3290-X; Superior Hand Brake Company, Drawing 566.

BRAKE BEAM—TRUSS ROD NUTS

The drawing illustrating the No. 15 A. A. R. Standard Brake Beam appearing on page E-83-Oct. 1, 1942, of the A. A. R. Manual of Standard and Recommended Practice, provides for the use of a 1¼-in. standard hexagon nut, seven threads per inch. Due to necessity for conservation of materials and difficulty being encountered in obtaining A. A. R. Standard cold-pressed truss-rod nuts, the use of Engineering

(*Continued on next left-hand page*)

Orders and Inquiries for New Equipment Placed Since the Closing of the September Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Carnegie-Illinois Steel Co.	23[1]	Diesel-elec. and steam	H. K. Porter Co.
Chicago & North Western	11[10]	1,000-hp. Diesel-elec.	American Loco. Co.
	7[10]	600-hp. Diesel-elec.	American Loco. Co.
	2[10]	1,000-hp. Diesel-elec. road switch.	American Loco. Co.

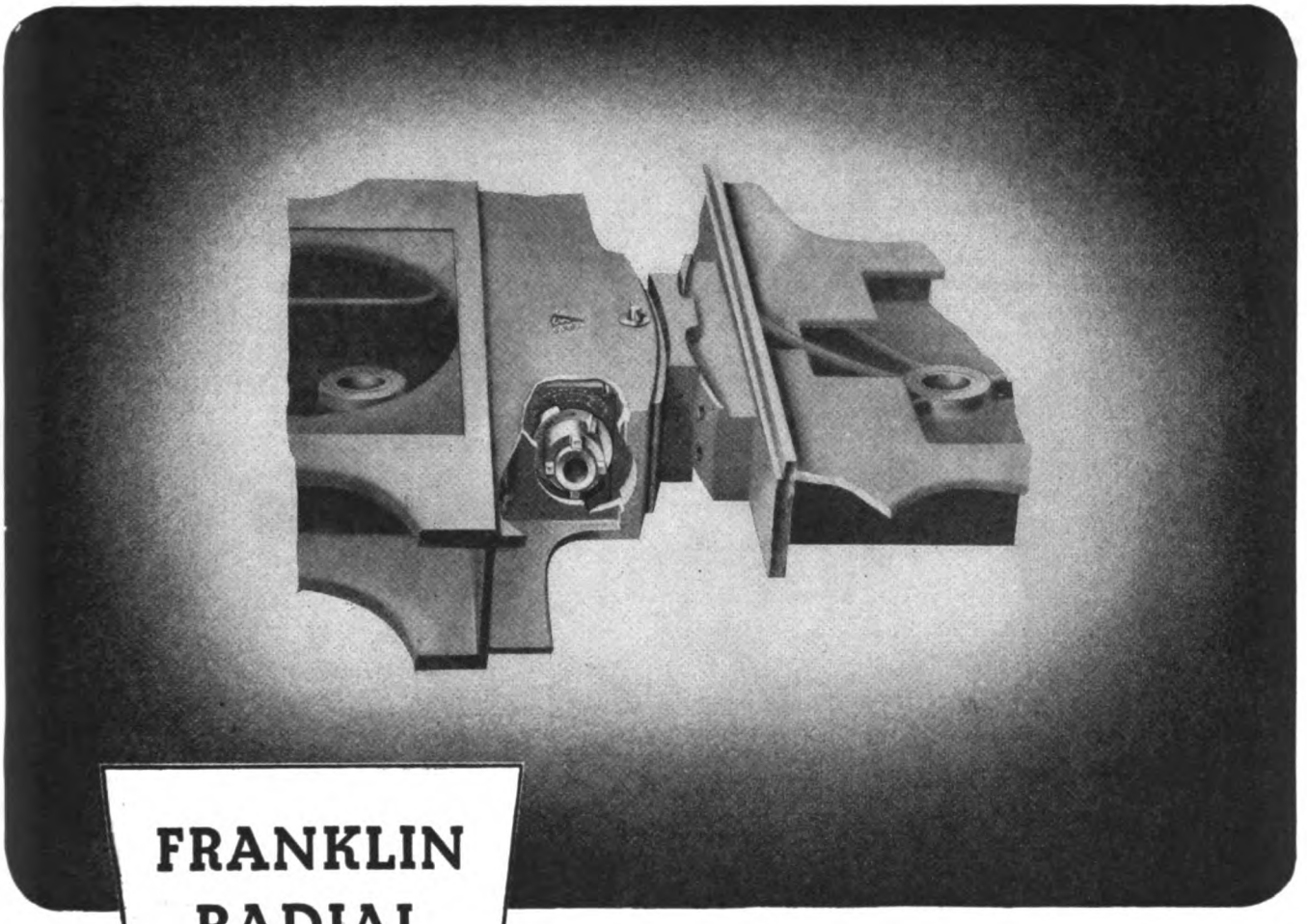
FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Atchison, Topeka & Santa Fe	200[2,4]	Flat	Pullman-Std.
Alton	250[2,4]	Gondolas	Gen. Amer. Trans.
	500	50-ton box	Pullman-Std.
	250[3]	50-ton hopper	American Car & Fdry.
Ann Arbor	25[2]	Box	Wabash shops
Central of Georgia	165[4]	50-ton flat	Greenville Steel Car
Chesapeake & Ohio	125	50-ton drop-end gondola	American Car & Fdry.
	100[4]	50-ton flat	Ralston Steel Car
Chicago & North Western	500[5]	70-ton ore	Bethlehem Steel
	250[5]	Flat	Pullman-Std.
Chicago, Milwaukee, St. Paul & Pacific	300[5]	50-ton auto box	Company shops
	100[6]	Hopper	Company shops
Chicago, Burlington & Quincy	400[9]	Hopper	Company shops
Illinois Central	500-600	50-ton gondola	Company shops
Indiana Harbor Belt	425[7]	Box	Despatch shops
Midland Valley	75[8]	Gondola	Mt. Vernon Car
New Jersey, Indiana & Illinois	50[4]	Box	Wabash shops
New York, Chicago & St. Louis	300[2]	50-ton box	Gen. Amer. Trans. Cp.
	200[2]	50-ton box	Pullman-Std.
	500[2]	50-ton hopper	American Car & Fdry.
	25	70-ton hopper	American Car & Fdry.
	50[2]	70-ton drop-end gondola	Greenville Steel Car
Pere Marquette	100[2]	70-ton drop-end gondola	Greenville Steel Car
	100[2]	70-ton flat	Greenville Steel Car
	25	70-ton covered hopper	American Car & Fdry.
Wabash	350[2,4]	Box	Company shops
	175[2,4]	Gondola	Company shops

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
Baltimore & Ohio	1,000-2,000	50-ton hopper	
Central of New Jersey	1,000	70-ton gondola	
	500	50-ton hopper	
	100	70-ton flat	
Seaboard Air Line	200	50-ton box	
	200	70-ton hopper	
Southern Pacific	500	50-ton gondola	

[1] Including six Diesel-electric and six steam locomotives of the 60- and 35-ton classes.
[2] Composite design.
[3] In addition to 500 hopper cars already on order with A. C. F.
[4] Authorized by WPB.
[5] Authorized by District Court at Chicago.
[6] In addition to 400 hopper cars already under construction. Authorized by WPB.
[7] Authorized by WPB. In addition to 575 box cars already on order with Despatch shops.
[8] Subject to WPB approval.
[9] Authorized by WPB. The 400 cars to be of composite wood and steel construction, are in addition to 600 already on order in company shops.
[10] Authorized by District Court at Chicago. In the event that the War Production Board allocates any or all of the locomotives to manufacturers other than the American Locomotive Company, the railroad was authorized to acquire the engines from the manufacturers designated.



FRANKLIN RADIAL BUFFER *steadies the ride*

Even the utmost attention to locomotive design details cannot prevent a certain amount of surging and nosing with consequent vibration and swaying. The use of the Franklin Radial Buffer, Type E-2, to connect engine and tender, prevents these forces from being transmitted to the tender and the rest of the train. In turn, the great mass of the tender serves as a steadying agent on the locomotive. By effectually dampening the movements of the locomotive a far smoother, safer ride is obtained.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.
NEW YORK • CHICAGO
In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

Standard hot pressed nuts as an alternate in making repairs to brake beams for use in interchange has been approved as an emergency measure for the duration.

H. E. McCandless Simmons-Boardman Vice-President

HERBERT E. MCCANDLESS, assistant to the president in charge of circulation of the Simmons-Boardman Publishing Corporation, has been elected a vice-president of the company. Mr. McCandless was born in New York City on January 18, 1890. He began his career in 1905 in the banking field



Herbert E. McCandless

in New York City and from 1911 to 1917 was with a New York public utility company. From September 10, 1917, until 1919 he served in the U. S. Army, receiving a sergeant's rating on December 1, 1917, and serving with the A.E.F. as dispatch carrier. Since 1920 he has been with Simmons-Boardman. In 1928 he became assistant to the president in charge of circulation.

Freight-Car Authorizations

SINCE the publication on September 1 of the new freight car releases by the War Production Board which are shown in the accompanying table, additional freight cars have been authorized for construction as part of the WPB domestic car-building program for the last six months of this year. With the new releases, the program as of the week ended September 18 totaled 17,596 cars, allocated among 32 railroads. Of the 17,596 cars, 6,942 were authorized for building in the railroads' own shops and 10,654 in contract car builders' plants. Included are 5,774 box cars, 10,070 hopper cars, 737 gondola cars, and 1,015 flat cars. No further details of the freight-car authorizations since September 1 are available.

As a result of these additional releases, the backlog of cars then on order without WPB authority to build barely exceeded 10,000, most of which were on order with the contract builders, and there has been an appreciable increase in the number of inquiries coming into the market. The total backlog of cars on order as of the week ended September 18, numbers about 40,000, including about 10,000 remaining to be delivered under the WPB's program for the first six months of the year, on which deliveries have lately been accelerated.

New Freight Car Releases by War Production Board as of September 1, 1943

Allocated for Fourth Quarter, 1943

Name of Railroad	No.	Type	Builder
Alton	750	Hopper	American Car & Foundry
	500	Box	Pullman-Standard
Atchison, Topeka & Santa Fe	400	Box	Pullman-Standard
	200	Flat	Pullman-Standard
Ann Arbor	25	Box	Wabash R. R. Shops
	25	Hopper	Wabash R. R. Shops
Baltimore & Ohio	150	Hopper	Bethlehem Steel
Central of Georgia	150	Box	Pullman-Standard
Chesapeake & Ohio	620	Hopper	American Car & Foundry
	100	Flat	Ralston Steel Car
Chicago & Northwestern	250	Flat	Pullman-Standard
Chicago, Burlington & Quincy	1,000	Hopper	Company Shops
Chicago & Great Western	100	Flat	Pullman-Standard
Chicago, Milwaukee, St. Paul & Pacific	200	Box	Company Shops
	500	Hopper	Company Shops
Clinchfield	300	Hopper	American Car & Foundry
Denver & Rio Grande Western	50	Gondola	Pressed Steel Car
Illinois Central	600	Hopper	Company Shops
Lehigh Valley	250	Gondola	Bethlehem Steel Car
	600	Hopper	Bethlehem Steel Car
Midland Valley	25	Hopper	American Car & Foundry
Missouri Pacific	550	Hopper	American Car & Foundry
New Jersey, Indiana & Illinois	50	Box	Wabash R. R. Shops
New York Central	1,000	Box[1]	Despatch Shops
New York, Chicago & St. Louis	200	Box	Pullman-Standard
Norfolk & Western	500	Hopper	Bethlehem Steel Car
	500	Hopper	Virginia Bridge
Reading	800	Hopper	Company Shops
St. Louis Southwestern	250	Box	Company Shops
St. Louis San Francisco	100	Box	Company Shops
Virginian	1,000	Hopper	Company Shops
Wabash	350	Box	Company Shops
	175	Gondola	Company Shops
Total	12,270		

Allocated for Third Quarter, 1943

Atchison, Topeka & Santa Fe	600	Box	General American
	200	Gondola	General American
	200	Hopper	General American
Atlantic Coast Line	150	Hopper	Bethlehem Steel Car
Atlanta & West Point and Western & Alabama	125	Box	Pullman-Standard
Baltimore & Ohio	350	Hopper	Bethlehem Steel Car
Birmingham Southern	100	Box	Pullman-Standard
Central of Georgia	100	Box	American Car & Foundry
	165	Flat	Greenville Steel Car
Chicago & Northwestern	502	Box	American Car & Foundry
	417	Box	Pullman-Standard
Chicago & Illinois Midland	62	Gondola	Mather Stock Car
Chicago, Burlington & Quincy	330	Box	Company Shops
Chicago, Milwaukee, St. Paul & Pacific	300	Box	Company Shops
Clinchfield	200	Hopper	American Car & Foundry
Denver & Rio Grande Western	200	Flat	Mount Vernon Car
Georgia	100	Box	Pullman Standard
Louisville & Nashville	350	Hopper	Pullman-Standard
Missouri Pacific	600	Hopper	American Car & Foundry
Pittsburg & Shawmut	100	Hopper	General American
Reading	200	Hopper	Company Shops
St. Louis Southwestern	150	Box	Company Shops
Fruit Growers' Express	300	Refrigerator	Company Shops
Total	5,801		

[1]For Indiana Harbor Belt

Applied Electronics

AT a demonstration of electronic devices for industrial application, held at the Schenectady plant of the General Electric Company, September 14, 1943, L. A. Umansky, assistant manager, Industrial Engineering Division, suggested caution in the use of such devices, as follows: "Nothing but harm will accrue to engineering progress, and more specifically to the electronic art, if electronics is used without discrimination just because it is relatively new and, therefore, fashionable." Following this note of caution, Mr. Umansky and five of his associates proceeded to outline the status and potentialities of applied electronics.

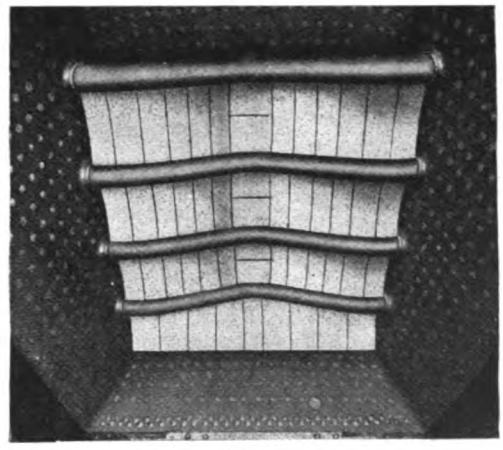
The magnitude of present applications is illustrated by the fact that in 1943 about 10 per cent of all electrical energy generated in the United States by any source of power will pass through electronic devices. A large part of this is the power required for electrochemical and light metal industries.

Examples given of railroad applications included rectifiers, varying in size from those supplying traction power on electrified railroads to those used for charging signal and control batteries. All electric arc welding falls within the definition of electronics. Amplifiers similar to those used in radio receivers find wide application in signaling service and, in fact, for increasing the current values induced in nearly all electronic detecting and control devices. The accurate control of resistance

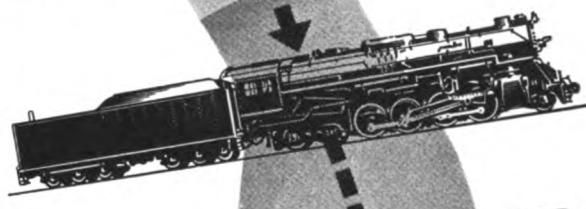
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Miscellaneous Publications

CARBON BRUSHES.—NEMA has published a second edition of the Carbon, Graphite and Metal-Graphite Brush Standards, Publication No. 43-85, superseding the one issued in 1934. The pamphlet, consisting of 16 pages bound and well illustrated, is devoted to standard dimensions and tolerances for carbon, graphite and metal-graphite brushes, and standards for associated parts of brushes such as shunt cables, clips, and connections. An entire section is devoted to definitions for brushes, thus promoting uniformity in the language used for referring to these parts. Copies may be obtained from the National Electrical Manufacturers Association, 155 East Forty-fourth street, New York, at 25 cents per copy.



TAKE THIS STEP FOR COAL CONSERVATION

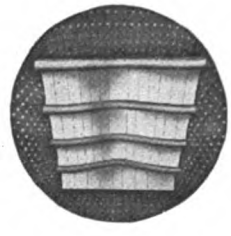




Coal on the tender represents not only certain dollars of expense but priceless man hours as well. Therefore, its careful conservation is a wartime duty « « A generation of railroad men have learned that Security Sectional Arches are easy on the coal pile. A complete arch in every locomotive firebox is a fundamental step towards fuel conservation.

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists



AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.
Locomotive Combustion Specialists

welding currents is another application. Through electronics, both resistance and arc welding now can be applied to light metals such as aluminum and magnesium. Fine and almost instantaneous control of motor speeds over wide ranges may be effected by electronic control. Very accurate control of furnace temperatures and other forms of heating is also made possible.

Among the newer applications are frequency converters which connect two a. c. power sources of different frequency through a d. c. intermediate circuit. This is done without the need of heavy rotating machinery. Other new applications include what might be called an extension of the human senses, since the devices can be made to respond accurately to light, sound, touch and temperature. Thus, actual values of vibration, sound, light and temperature, can be measured numerically. Minute changes in speed, such as a change from 1,800 to 1,800.1 r.p.m. can be detected. Actual speeds up to 300,000 r.p.m. can be measured. Induction heating is being applied effectively to accurate surface hardening of metal parts and also to the heating of non-conductors as, for example, the assembly of laminated plywood sections with synthetic resins. In the latter case, the time of heating has in many instances been reduced to less than 10 per cent of the time formerly required in steam ovens.

Many practical and successful applications of circuit control were described and demonstrated, and a guide for determining the value of such applications was offered by E. H. Alexander, engineer, Industrial Control Division, General Electric Company, as follows: "It is doubtful if electronic devices will ever approach the lower cost of contactors and relays for a given current rating. If the contactor, relay or rheostat will do the job well enough, it is not sound engineering to propose the electronic way; but if the magnetic way cannot do the job quickly enough, if it wears out too quickly, or if the open arc is objectionable, the electronic way may justify its extra cost."

Action on Manpower Demanded by Eastman

WARNING that "the United States is headed for a crisis in railroad manpower unless drastic remedies are undertaken immediately," Director Joseph B. Eastman of the Office of Defense Transportation during the week ended September 11 promulgated a "must" program of 13 points, including a threat to call for mandatory Interstate Commerce Commission orders suspending state full-crew laws and train and engine service mileage limitations. The suggested opportunities for relief, Mr. Eastman asserted, "must be pursued at once, no matter how foreign they may be to past customs and practices."

The program calls for action "by management and labor with the assistance of the government." Copies were thus sent to the Association of American Railroads, the American Short Line Railroad Association, the Railway Labor Executives' Association, the chief executive of each individual railroad, the head of each railroad labor organization, and to each government agency whose help may be needed. Mr. Eastman plans to call conferences where joint action is necessary, but he felt that much of the program could be put into immediate effect by individual roads.

The program's 13 points are as follows:

1. Prepare and file replacement schedules with Selective Service authorities so as to provide for the retention in railroad employment as long as possible of essential employees subject to Selective Service for whom replacements are not readily available and also to provide for the orderly withdrawal of railroad employees subject to Selective Service.
2. Organize and conduct a special railroad employee recruiting drive on an aggressive basis with the help of all available federal agencies.
3. Recruit and enlist services of women employees to the fullest possible extent.
4. Establish special regional pools of train, engine, yard, shopcraft, and other skilled employees under auspices of regional managers designated, respectively, by the Eastern, Southern, and Western railroads, and make special assignments from such pools wherever manpower emergencies develop in the regions concerned.
5. Secure full complements from war manpower authorities, for each railroad requiring unskilled labor, of (a) Mexican workers, (b) prisoners of war.
6. Without further delay make adjustments in existing working conditions wherever necessary to permit payment of time and one-half after eight hours for maintenance-of-way work.
7. Inaugurate immediate steps in cooperation with appropriate federal agencies to improve housing, eating, and commissary facilities wherever such facilities are now inadequate.
8. Expand immediately training programs with provision for payment of trainees during their training period.
9. Establish immediately effective plans for reporting current personnel shortages by occupation.
10. Establish labor-management cooperative committees to improve service and conserve manpower.
11. Establish means of assuring railroads a high labor priority in areas of critical labor shortage.
12. The suspension for the duration, in certain circumstances, of the operation of so-called full-crew laws.
13. The suspension for the duration, in certain circumstances, of train- and engine-service mileage limitations still in effect which result in under-utilization of train- and engine-service employees.

The suggestion for cooperative labor-management action to improve service and conserve manpower (No. 10) is spelled out as a call upon management to go in for regular local, divisional and system joint conferences with labor representatives. "Representatives of railroad labor, particularly in train and engine service," the statement says, "have indicated their desire that such a program be developed. Thus far management has not manifested the necessary interest."

The program's detailed discussion of the first point (that calling for the preparation of replacement schedules) explains that the replacement schedule constitutes a list of those employees eligible for induction, together with what is, in effect, an agreement between the railroad and the Selective Service System as to which and how many employees may be inducted and the dates after which these inductions may be made.

ODT now stands ready to recommend to the Bureau of Selective Service of the War Manpower Commission a 60-day moratorium, on the induction of railroad workers in essential occupations "to be granted each railroad notifying appropriate State Selective Service Directors and the Office of Defense Transportation of its intention to prepare and file replacement schedules." Such a moratorium, if granted, "will be allowed for the sole purpose of completing and filing replacement schedules within the 60-day period stipulated. It will mean a stay of action on the induction of railroad employees in essential jobs during the moratorium period, but it does not mean blanket deferment."

The discussion of the fifth point, which relates to the employment of women, cites the Pennsylvania and Southern Pacific as having done relatively more than other roads in recruiting women employees. It then adds: "Not even the few companies that have been aggressive in this matter have by any means exhausted the possibilities." Meanwhile, the railroad labor organizations, with "no uniform policy," have "both helped and hindered." It is suggested that labor "should help consistently by agreeing, for the duration, to the modification of the seniority provisions of their labor agreements which militate against the employment of women."

The closing statement in the outline of the program says that if the suggested measures prove insufficient to meet the situation, "the only recourse will be further legislation by Congress," and ODT "will do what it can to promote such legislation." Meanwhile, Mr. Eastman, in the letter of transmittal, had expressed his belief "that the responsible officials of the railroads and of railroad labor organizations have the energy and capacity to meet the manpower problems of the railroads"; and he pledged "the full assistance" of the ODT.

Arthur G. Tartas

ARTHUR G. TARTAS, head of the Simmons-Boardman Publishing Corporation, editorial drafting department, which has served the *Railway Mechanical Engineer* since December, 1911, died on August 22. Mr. Tartas had served the Railway Age and its predecessors in this capacity for the past 54 years.

Born in England on March 21, 1869, Mr. Tartas was graduated from Clayton College, London, England. He was for two years draftsman and clerk of works in an architect's office, coming to this country in 1889 and becoming editorial draftsman for the Railroad Gazette (since incorporated in the Railway Age). He was appointed chief draftsman in 1892. That was back in the days of wood engravings—and the art of reproducing large drawings for publication within the limited compass of the printed page was in its infancy.

Mr. Tartas contributed in no small measure to the advancement of this technique—so necessary to effective technical journalism. Its peculiar and difficult problem is that of selecting the really essential characteristics of a large working drawing, combining them into a smaller reproduction—which conveys the necessary information to the informed reader, while eliminating the multitude of details which, in an engraving small enough for publication, would become a confusing smudge.

The present standards of technical drawings in the Railway Age, the *Railway Mechanical Engineer* and other Simmons-Boardman publications have largely resulted from the long efforts of Arthur Tartas in this important specialized field.

Supply Trade Notes

INTERNATIONAL NICKEL COMPANY.—*T. H. Wickenden,* assistant manager, has been appointed manager of the development and research division of the International Nickel Company to succeed the late *Albion James Wadhams. H. J. French,* who is temporarily serving in the steel division of the War Production Board in Washington, D. C., and has been in charge of alloy-steel development in International Nickel's development and research division at New York since 1932, has been appointed assistant manager of the division.

◆

ERNEST H. WEIGMAN RAILWAY SUPPLY COMPANY.—*Ernest H. Weigman* has resigned as vice-president in charge of sales of the Grip Nut Company, Chicago, to establish the Ernest H. Weigman Railway Supply Company at 310 South Michigan avenue. He will represent the Grip Nut Company in Chicago and Central-West territories.

◆

SAFETY CAR HEATING & LIGHTING COMPANY.—*Charles W. T. Stuart,* southeastern district manager of the Safety Car Heating & Lighting Company, and Philadelphia, Pa., manager of the Vapor Car Heating Company, has been appointed assistant to the president of the Safety Car Heating & Lighting Co., with headquarters in New York. Mr. Stuart, who is a graduate of the Drexel Institute of Technology, began his business career with the Baldwin Locomotive Works in 1908. He was employed in the motive power department of the Pennsylvania from 1909 to 1924. He joined the Safety Car Heating & Lighting Co. in 1924 and served as a sales representative until 1933 when he



Charles W. T. Stuart

was appointed southeastern district manager for the company and Philadelphia manager of the Vapor Car Heating Company. Mr. Stuart is the author of the book "Car Lighting by Electricity" which was originally published as a series of articles in the "Railway Electrical Engineer" in 1921 and 1922.

LINCOLN ELECTRIC COMPANY.—*William J. Conley,* former chairman of the engineering department of the University of Rochester, has been appointed consulting engineer for the Lincoln Electric Company, Cleveland, Ohio.

◆

OKONITE COMPANY.—*J. W. Hackett* has rejoined the sales organization of the Okonite Company after a two-year period as associate engineer with the corps of engineers, War Department, and more recently with the production section military supplies, New York District. Prior to his work with the corps of engineers, Mr. Hackett was associated with Okonite for 15 years as a specialist in the sale of insulated wires and cables for railroads. During his earlier career, he was employed as an apprentice engineer with the Union Switch & Signal Co., as an engineer in the signal department of the New York Central, and with the Federal Signal Company, predecessor of the General Railway Signal Company. Mr. Hackett will be attached to the New York sales office of the Okonite Company where he will again specialize in sales engineering for the railroad department.

◆

TIMKEN ROLLER BEARING COMPANY.—*W. H. Richardson,* assistant general sales manager of the Timken Roller Bearing Company, has been appointed general manager of all activities of all divisions of the company in eleven western states bordering on the west coast and in the Orient. He will make his headquarters in San Francisco, Calif. Mr. Richardson joined the Timken Company in 1917, and served in various sales capacities until 1929 when he was appointed manager of the Timken Roller Bearing Service & Sales Co., and vice-president of the Timken Roller Bearing Company, Ltd., of Canada, in which capacities he handled the sale of bearings for replacement in the United States, Canada, Latin American countries and the Orient. He became assistant general sales manager in 1941.

◆

GENERAL ELECTRIC COMPANY.—*W. F. Rauber* has been appointed manager of sales of the General Electric Company's outdoor and station equipment section. After his graduation from Notre Dame University with a degree in electrical engineering, Mr. Rauber took the General Electric test course in 1923. He was assigned to the switchgear sales department in 1924, and became a switchgear specialist in the company's Cincinnati, Ohio, office in 1928. He moved to the Cleveland, Ohio, office in the same capacity in 1931 and to Philadelphia, Pa., in 1936. He subsequently was appointed general assistant in the power circuit breaker sales section, which position he held until his present appointment.

◆

ALLEGHENY LUDLUM STEEL CORPORATION.—*J. W. Burdick,* salesman for the Allegheny Ludlum Steel Corporation, has been appointed assistant district manager of the company's Springfield, Mass., office and *J. T. Purtell,* assistant manager of orders at the Watervliet, N. Y., plant, has been transferred to the Springfield district as a salesman.

◆

GUSTIN-BACON MANUFACTURING COMPANY.—*Albert L. Gustin, Jr.,* vice-president of the Gustin-Bacon Manufacturing Company, Kansas City, Mo., has been elected president to succeed Albert L. Gustin, Sr.,



Ken Newman

Albert L. Gustin, Jr.

deceased. Mr. Gustin, Jr., was born at Kansas City, Mo., on March 6, 1904, and was educated at Culver Military Academy, Lawrenceville Academy, Missouri University and Pennsylvania University, from which latter institution he was a graduate in 1927. He then entered the employ of the Missouri-Kansas-Texas as a machinist apprentice and later resigned to enter the service of his father's company. In 1930 he was elected vice-president.

◆

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—*Ralph C. Stuart* has been appointed manager of the lamp division of the Westinghouse Electric & Manufacturing Co., with headquarters in Bloomfield, N. J. Mr. Stuart, who has been with the Westinghouse Electric & Manufacturing Company and the Canadian Westinghouse Company for 25 years, was

(*Continued on second left-hand page*)

Army-Navy E Awards

American Car and Foundry Co., Berwick, Pa. August 19.

Copperweld Steel Company, Glassport, Pa. August 24.

Handy & Harman, Bridgeport, Conn. August 21.

Silent Hoist Winch & Crane Co., Brooklyn, N. Y.


SPOTLIGHTING
DIESEL SERVICE
400
BALTIMORE AND OHIO
57
BALTIMORE & OHIO
GENERAL MOTORS
LOCOMOTIVES

B&O

LEADERSHIP..

LATE IN 1830, Peter Cooper's *Tom Thumb* became the first steam locomotive on the Baltimore and Ohio Railroad, leading the way to a new era in transportation. The horse was doomed . . . More than a century later (August, 1935), the B. & O. again took the lead by placing in service the first Diesel road locomotive on any American railroad. Today, it leads the East with 81 General Motors Diesel Locomotive Units totaling 102,600 horsepower in all classes of service — with more to come.

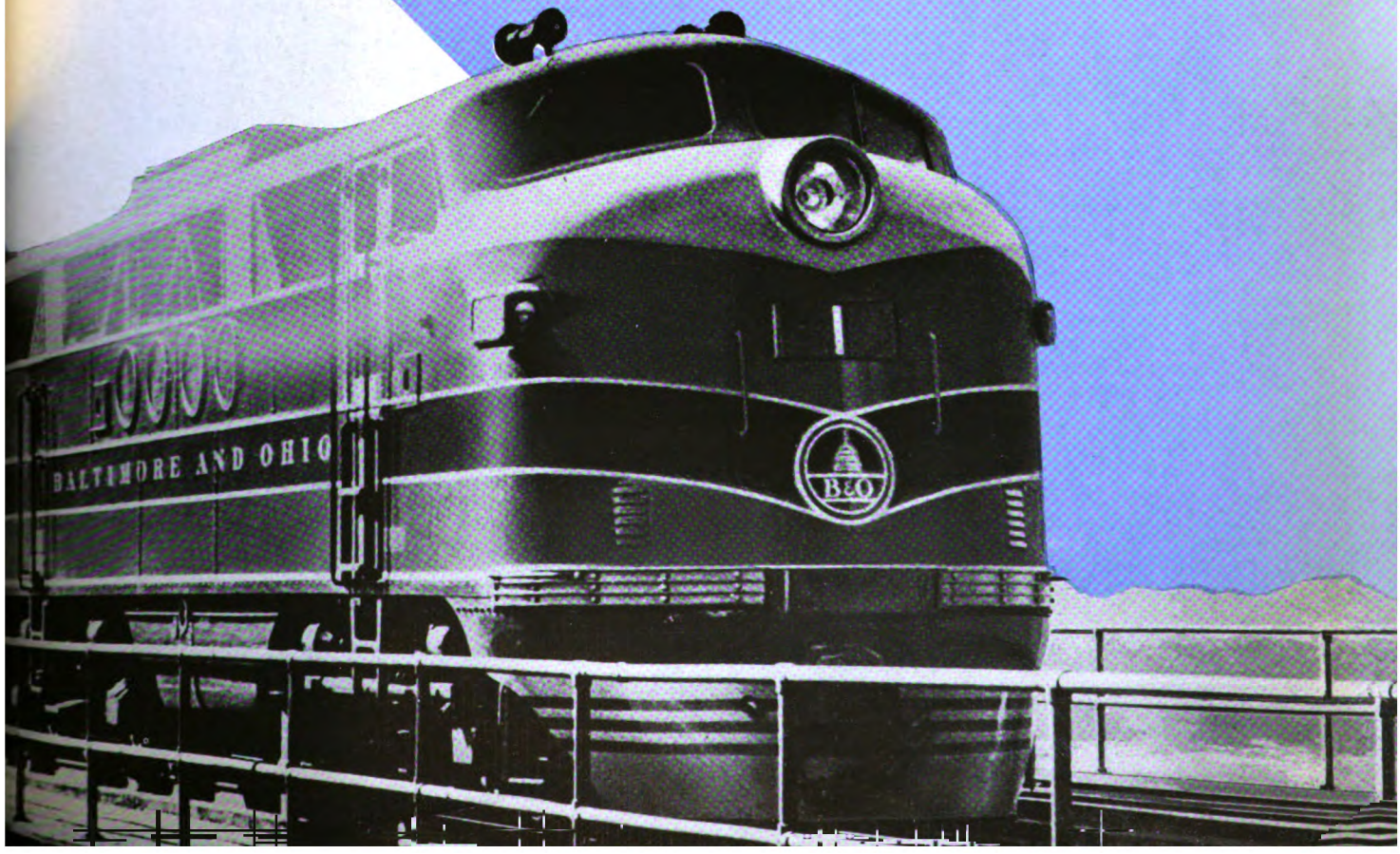
Available records of 63 Diesel units show well over 15 million miles operated with 94 percent average availability. What other type of motive power can match such outstanding performance?

★ **BACK THE ATTACK — BUY MORE WAR BONDS** ★

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION

LA GRANGE, ILLINOIS, U. S. A.



transferred to the Bloomfield headquarters plant of the division in January, 1941, from the West plant of the Canadian Westinghouse Company at Hamilton, Ont., where he had been manager from 1930 until 1941.

◆

REYNOLDS METAL COMPANY.—The Railway Supply division of the Reynolds Metal Company, Richmond, Va., has been organized, with headquarters at Chicago, to manufacture and sell lightweight metals, principally aluminum, and locomotive and car parts. *J. W. Burnett,* who retired as general superintendent of motive power and machinery of the Union Pacific in 1940, has been appointed manager of the division, and *W. A. Stevens,* formerly secretary to B. M. Vincent, congressman of the Second district of Kentucky, has been appointed assistant to the manager.

J. W. Burnett was born at McCook, Neb., on October 19, 1890, and entered railway service in 1909 with the Chicago, Burlington & Quincy at McCook. In 1912 he resigned to enter the employ of the Union Pacific as a machinist apprentice at Cheyenne, Wyo. In the following year he became foreman at Kearney, Neb.; in 1917, became foreman at Laramie, Wyo., and in 1921 master mechanic at Green River. In the following year he was transferred to Cheyenne. In August, 1928,



J. W. Burnett

he was appointed assistant superintendent of motive power and machinery at Omaha, Neb.; superintendent of motive power and machinery in December, 1928, and general superintendent of motive power and machinery in 1933. From 1936 to 1938 he served as chairman of the Mechanical Division of the Association of American Railroads.

AMERICAN LOCOMOTIVE COMPANY.—*Lawrence B. Jackson* has been appointed director of engineering, Diesel Division, of of the American Locomotive Company. Mr. Jackson is a graduate of Stevens Institute of Technology. After service with the American Hawaiian S. S. Company as superintending engineer and with the Texas S. S. Company as plant engineer at the Bath, Maine, shipyard, and superintendent of Technical Division, Marine Department, he became associated with Fairbanks Morse & Company in 1925. In the latter organization he advanced from the position of engineer, marine applications, to the assignments of assistant chief engineer and chief engineer of the Diesel Division; manager, marine Diesel sales, in Chicago; manager, New England (sales) branch at Boston, and manager of engineering in 1936. Mr. Jackson has contributed to various technical journals on subjects relating to internal combustion engines, and is the inventor of an interlock hydraulic control for water gas manufacturing and an exhaust silencer. He is a member of the American Society of Mechanical Engineers, serving on the Power Code Test Committee; the Society of Automotive Engineers, and Society of Naval Architects and Marine Engineers. He is also a member of the Technical Committee of the American Bureau of Shipping.



L. B. Jackson

◆

H. K. PORTER COMPANY.—*F. B. Schwartz,* manager of the Minnesota Pneumatic & Electric Tool Co., Minneapolis, Minn., has been appointed special representative for the northwest for the complete line of products of the H. K. Porter Company, Pittsburgh, Pa. Mr. Schwartz was in the employ of the Chicago Pneumatic Tool Company from 1926 to 1935, and had been assistant manager at Chicago. He has been with the Minnesota Pneumatic & Electric Tool Co. since 1935.

◆

METALLIZING COMPANY OF AMERICA.—The Metallizing Company of America, with general offices at Chicago, has purchased a new building at 135 Cedar street, New York, in which headquarters for sales and service operations in the eastern area have been established. The building is a complete operating unit, with development and test laboratories, warehouse facilities, and general service departments. There is also a complete demonstration shop with a typical operating metallizing set-up. *V. A. Cook* continues in charge of eastern operations.

Obituary

JOHN T. LUSCOMBE, sales manager of the United States Metallic Packing Company, Philadelphia, Pa., died in Orlando, Fla., on September 13.

◆

ALBERT L. GUSTIN, SR., president of the Gustin-Bacon Manufacturing Company, Kansas City, Mo., died in that city on August 28 of a heart ailment. Mr. Gustin was born at Neponset, Ill., on June 20, 1875, and entered the railway supply business in 1898 under the name of Albert L. Gustin. He had been president of the present company since its incorporation in 1903.



Albert L. Gustin

Personal Mention

General

W. E. BARNES, general superintendent of motive power and car equipment of the Atlantic region of the Canadian National, at Moncton, N. B., has retired

A. R. CARSON, superintendent of shops of the Canadian National, has been appointed acting superintendent motive power and car equipment, with headquarters as before at Moncton, N. B.

ALAN BEARDSHAW, superintendent of motive power and car equipment of the Southern Ontario district of the Canadian National, with headquarters at Toronto, Ont., has been appointed general superintendent of motive power and car equipment of the Western region at Winnipeg, Man.

JOHN KYLE, general superintendent of motive power and car equipment of the Western Region of the Canadian National at Winnipeg, Man., has retired.

ERNEST WADSWORTH PEARSON, assistant chief draftsman (car) of the Canadian National, has been appointed mechanical engineer (car), at Montreal, Que.

G. S. GOODWIN, formerly mechanical engineer, Chicago, Rock Island & Pacific, retired from railway service on September 20. Mr. Goodwin attended public schools in Ithaca, N. Y., and was a graduate in mechanical engineering from Cornell University in 1899. He entered railway service as a special apprentice at the Milwaukee, Wis., shops of the Chicago, Milwaukee, St. Paul & Pacific and, after completing the shop work, was transferred to the drafting office. During this latter period he had charge of the Milwaukee dynamometer car, making numerous tests on the Milwaukee and neighboring lines which used the car. In May, 1904, Mr. Goodwin went with the Great Northern as leading locomotive draftsman and in January, 1906, resigned to enter the employ of the Chicago, Rock Island & Pacific as chief draftsman, a position which he held until 1910. Mr. Goodwin was appointed assistant mechanical engineer in 1910; mechanical engineer of locomotives in June, 1913; corporate engineer in October, 1918; mechanical engineer, locomotives and cars, in February, 1921, assistant to the general superintendent of motive power in May, 1927. Mr. Goodwin held this position for 11 years and then resumed the title of mechanical engineer until June, 1943, when he was appointed engineer of car construction. During this period of nearly 38 years, Mr. Goodwin has seen the wood freight and passenger cars give way to steel, and locomotives grow from 10 wheelers with a tractive force of just over 30,000 lb. to the present 4-8-4 type with tractive force approaching 100,000 lb. He has had to do with the design of all the motive power and rolling stock now in use on the Rock Island, including the 5,000 Class 4-8-4 locomotives which have given notably good results on that road from the point of view of adaptation to modern speed and power requirements. Mr. Goodwin has been active in the work of the A. A. R., Mechanical Division, having been a member of the Car Construction committee for over 20 years. He also served as chairman of the Tank Car Committee for a number of years, during which time the question of autogenous welding of tank car tanks was active. It was through the efforts of the Tank Car Committee that approval of the Interstate Commerce Commission was finally secured for such construction. Mr. Goodwin served as president of the Western Railway Club in 1919-20.



Moffett Studio

G. S. Goodwin

B. L. THOMPSON has been appointed mechanical inspector of the Canadian National, with headquarters at Montreal, Que.

H. M. MCINNES has been appointed assistant to the chief mechanical officer of the Pere Marquette, with headquarters at Detroit, Mich.

C. W. BROWN, JR., has been appointed engineer tests of the Western Maryland, with headquarters at Hagerstown, Md. The position of chief chemist, formerly held by Mr. Brown, has been abolished.

P. R. BROADLEY, chief marine engineer of the Central of New Jersey at Jersey City, N. J., has been appointed mechanical engineer, with headquarters at Elizabethport, N. J., succeeding G. W. Rink, who has resigned from that position.

R. R. SNEDDON, master mechanic of the New York Central at Jackson, Mich., has been appointed assistant to the superintendent of equipment at Detroit, Mich.

ARVID L. OLSON, who has been appointed assistant mechanical engineer of the Chicago, Rock Island & Pacific at Silvis, Ill., as announced in the July issue, was born on November 16, 1900, at Moline, Ill. He received a high school education and took extension courses, entering the service of the Rock Island on December 1, 1917, as a messenger. On July 1, 1918, he became a clerk in the pattern department at Silvis; on April 1, 1919, draftsman; on June 1, 1932, chief draftsman, and on June 1, 1943, assistant mechanical engineer.

JESSE H. DAVIS, chief engineer-electric traction, of the Baltimore & Ohio, with headquarters at Baltimore, Md., retired from railroad service on October 5. Mr. Davis was born on October 7, 1874, at Forest City, Ark., and was a graduate of the University of Arkansas with a B. E. E. degree in 1900. He entered railroad service in 1900 as an employee of the Choctaw, Oklahoma & Gulf (now Chicago, Rock Island & Pacific), serving as assistant engineer on survey and construction. On March 17, 1901, he went with the Pennsylvania as draftsman in the electrical department at Altoona, Pa., serving in that capacity until October, 1905, when he left to become assistant electrical engineer of the Baltimore & Ohio at Baltimore. On May 10, 1909, he was promoted to the position of electrical engineer, and on September 1, 1924, was appointed chief engineer-electric traction, continuing the duties he formerly handled and in addition becoming responsible for the design and installation of the electrified facilities of the Staten Island Lines. This work was completed in 1926, and shortly thereafter, the University of Arkansas conferred upon Mr. Davis the degree of Electrical Engineer, in recognition of a paper presented by him concerning that electrification project. Throughout his 38 years of service with the B. & O., Mr. Davis was actively engaged in the modernization and improvement projects of that road. He was largely responsible for the substitution of electric lighting facilities for outmoded oil and gas lighting on B. & O. passenger cars. He designed, constructed, and supervised operation and maintenance of all power-plant and allied facilities of the system. In July, 1929, he designed and tested a completely equipped air-conditioned railway passenger car, and supervised design for the Martha Washington, the air-conditioned dining car which made its initial trip on April 14, 1930. His achievements further included an automatic battery charging station at Locust Point, Baltimore, in 1941, and the fluorescent seat lighting arrangement in the waiting room of Union station, Washington, D. C. His research in electronics resulted in the discovery that radio waves could be used for insect extermination, a process which is now in operation in commercial plants. Mr. Davis served as chairman of the Committee on Transportation sponsored by the American Institute of Electrical Engineers under the direction of the American Standards Association. He is a life member of the American Institute of Electrical Engineers; a member of the Electrical Section, Engineering Division, of the Association of American Railroads; Electrical Section, Mechanical Division, A. A. R.; American Railway Engineering Association, and the American Transit Association.



Jesse H. Davis

C. A. NICHOLSON, assistant to the superintendent of motive power of the St. Louis Southwestern, has been promoted to assistant superintendent of motive power, with headquarters as before at Pine Bluff, Ark.

Master Mechanics and Road Foremen

H. L. CRANE has been appointed assistant division master mechanic of the Union Pacific, with headquarters at Pocatello, Idaho.

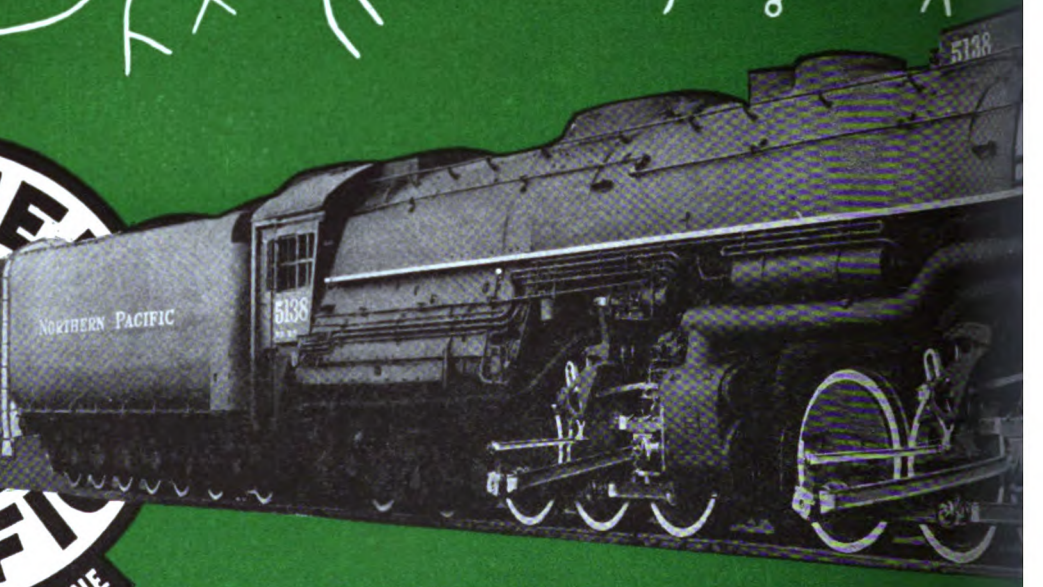
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48 MODERN HIGH-POW

ON THE

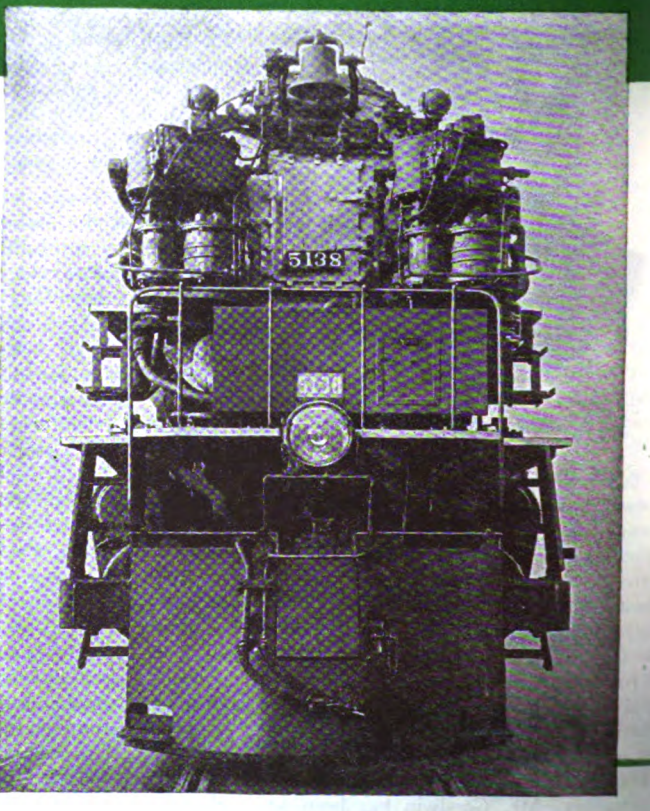
NORTHE PACIFI

YELLOWSTONE PARK LINE



Locomotive Characteristics

Weight on Drivers	440,000 Lb.
Weight of Engine	644,000 Lb.
Cylinders (Four)	23 x 32 Ins.
Diameter of Drivers	70 Ins.
Boiler Pressure	260 Lb.
Tractive Power	106,900 Lb.
Tender Capacity—Fuel	27 Tons
Tender Capacity—Water	25,000 Gals.

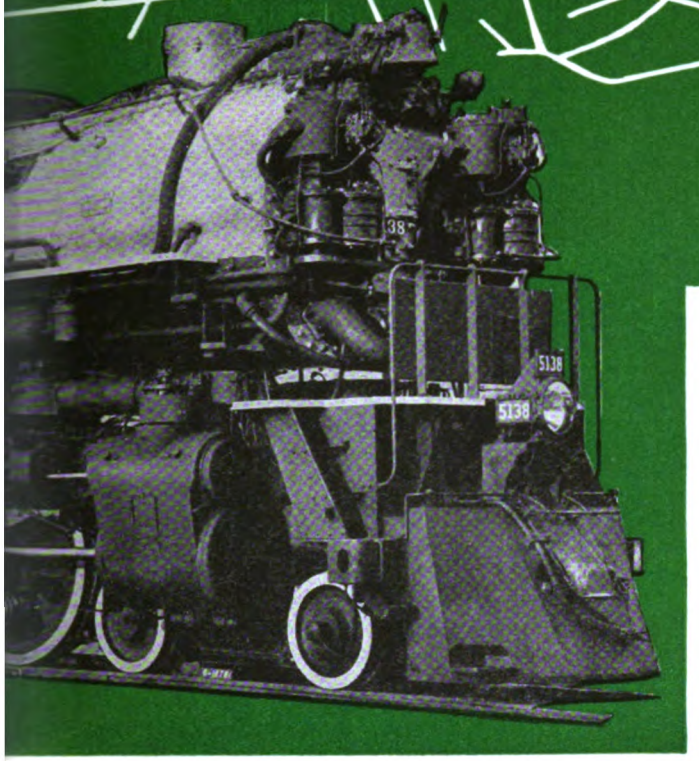


★ ★ ★ ★ ★ ★ ★ ★ ★

FOR VICTORY BUY U. S. WAR BONDS AND STAMPS

RED 4-6-6-4's

"Main Street of the Northwest"



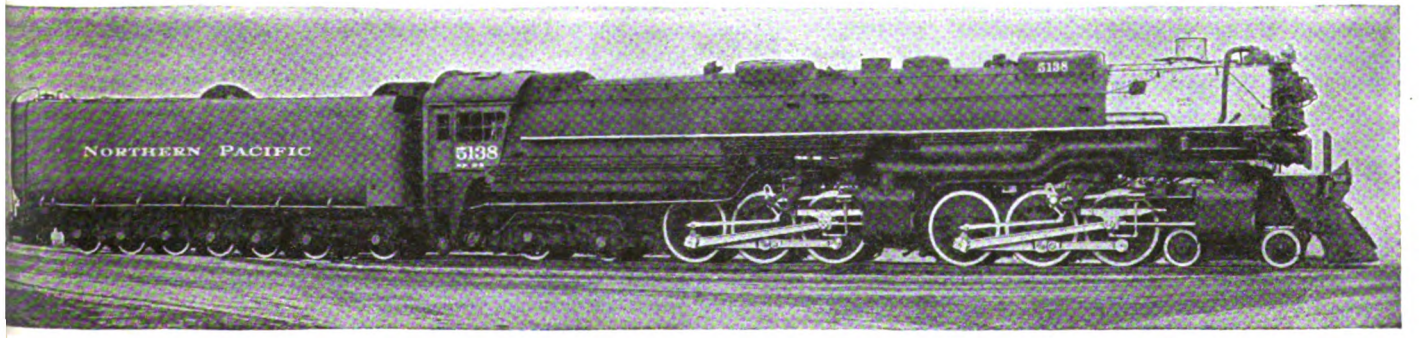
Alco recently received an order from the Northern Pacific—"The Main Street of the Northwest"—for eight 4-6-6-4 type single-expansion articulated locomotives. Upon the completion of this order, Alco will have delivered 48 of these modern high-powered 4-6-6-4 type locomotives to this road—all delivered since 1936.

Alco

AMERICAN LOCOMOTIVE

MANUFACTURERS OF MOBILE POWER

STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, MARINE DIESELS, TANKS, GUN CARRIAGES & OTHER ORDNANCE



P. B. RICE, who has been appointed master mechanic of the Houston division of the Southern Pacific at Houston, Tex., as announced in the August issue, was born on April 9, 1901, at Ennis, Tex. He had



P. B. Rice

nine years' schooling at Ennis and a course on supervision with the Railway Educational Bureau from May, 1940, to May, 1942. He entered the service of the Southern Pacific on September 19, 1916, as a machinist apprentice. He became a machinist in 1921 and was promoted to the position of drop-pit foreman at Houston in April, 1922. In 1936 he was appointed general enginehouse foreman and on July 1, 1943, became master mechanic of the Houston division.

C. A. WILLINGHAM has been appointed master mechanic of the Interstate, with headquarters at Andover, Va.

ARTHUR LEO KNIGHT has been appointed road foreman of engines, Rivanna subdivision, of the Chesapeake & Ohio, with headquarters at Richmond, Va.

W. H. LONGWELL, master mechanic of the Baltimore & Ohio at Grafton, W. Va., has been transferred to the position of master mechanic at Cumberland, Md.

E. STIMSON, JR., master mechanic of the Baltimore & Ohio at Benwood, W. Va., has been transferred to the position of master mechanic at Grafton, W. Va.

W. E. BRAUTIGAM, assistant master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Deer Lodge, Mont., has been appointed master mechanic at Deer Lodge.

R. A. CONNER, master mechanic of the Baltimore & Ohio at Holloway, Ohio, has been transferred to the position of master mechanic at Benwood, W. Va.

J. L. BROSARD, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Savanna, Ill., has been transferred to Chicago.

C. R. HEMING, assistant master mechanic of the New York Central at Niles, Mich., has been appointed master mechanic, with headquarters at Jackson, Mich.

E. M. TAPP, assistant master mechanic of the Union Pacific at Pocatello, Idaho, has been appointed to master mechanic of the Washington division, with headquarters at Spokane, Wash.

E. SEARS, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Deer Lodge, Mont., retired on September 1.

H. A. ROLLWAGEN, general car foreman of the Chicago, Burlington & Quincy at Omaha, Neb., has been appointed to fill the newly created position of assistant master mechanic at Chicago.

Shop and Enginehouse

WINSBY WALKER, general foreman of motive power shops of the Canadian National at Montreal, Que., has been appointed superintendent of the system's shops, with headquarters at Moncton, N. B.

Obituary

HARRY P. ALLSTRAND, chief mechanical officer of the Chicago & North Western, with headquarters at Chicago, died suddenly at his home in that city on September 5. Mr. Allstrand was born at Council Bluffs, Iowa, on September 8, 1885, and was a graduate of Iowa State College in 1913. He entered railway service in 1903 as a machinist apprentice of the North Western at Missouri Valley, Iowa, and in 1907 was promoted to machinist and later to fore-



Harry P. Allstrand

man. In 1909, he left railway service to attend college at Ames, Iowa, returning to the North Western after graduation in 1913, as enginehouse foreman, serving successively at Clinton, Iowa, South Pekin, Ill., Proviso, and East Clinton, Iowa. Mr. Allstrand became division foreman at Chadron, Neb., in 1918, and in 1919 assistant master mechanic. He later served as master mechanic at Chadron and at Eagle Grove, Iowa, Belle Plaine and Boone. In 1924 he was appointed efficiency supervisor, with headquarters at Chicago; in 1926, assistant superintendent of motive power and machinery; in 1929, principal assistant superintendent of motive power and machinery, in August, 1939, assistant to the chief executive officer, and on December 1, 1941, chief mechanical officer. Mr. Allstrand was a past president of the Western Railway Club in Chicago.

GEORGE LAWSON, road foreman of engines of the Chesapeake & Ohio at Richmond, Va., died on July 8 at the age of 62. Mr. Lawson had been in railroad service for 39 years.

READING D. BULLUCK, who retired as master mechanic of the Atlantic Coast Line at Wilmington, N. C., on August 1, 1935, died on August 9, at Rocky Mount, N. C. Mr. Bullock was 78 years old.

T. F. SULLIVAN, master mechanic of the Texas & New Orleans, with headquarters at Ennis, Tex., died recently at his home in that city.

WALTER S. JAMES, electrical engineer of the Erie, with headquarters at Cleveland, Ohio, died recently at his home in Shaker Heights, Ohio.

FRED H. MEINCKE, supervisor of locomotive operation of the Delaware, Lackawanna & Western at Scranton, Pa., died on August 30 of injuries received at Wayland, N. Y., when a freight engine collided with the Lackawanna Limited, a D. L. & W. New York-to-Buffalo express, in the cab of which he had been riding when the accident occurred. Mr. Meincke was 55 years old.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

THREAD GRINDER.—Landis Machine Company, Waynesboro, Pa. Twelve-page bulletin E-93. Illustrates and describes the Landis No. 6 precision thread grinder.

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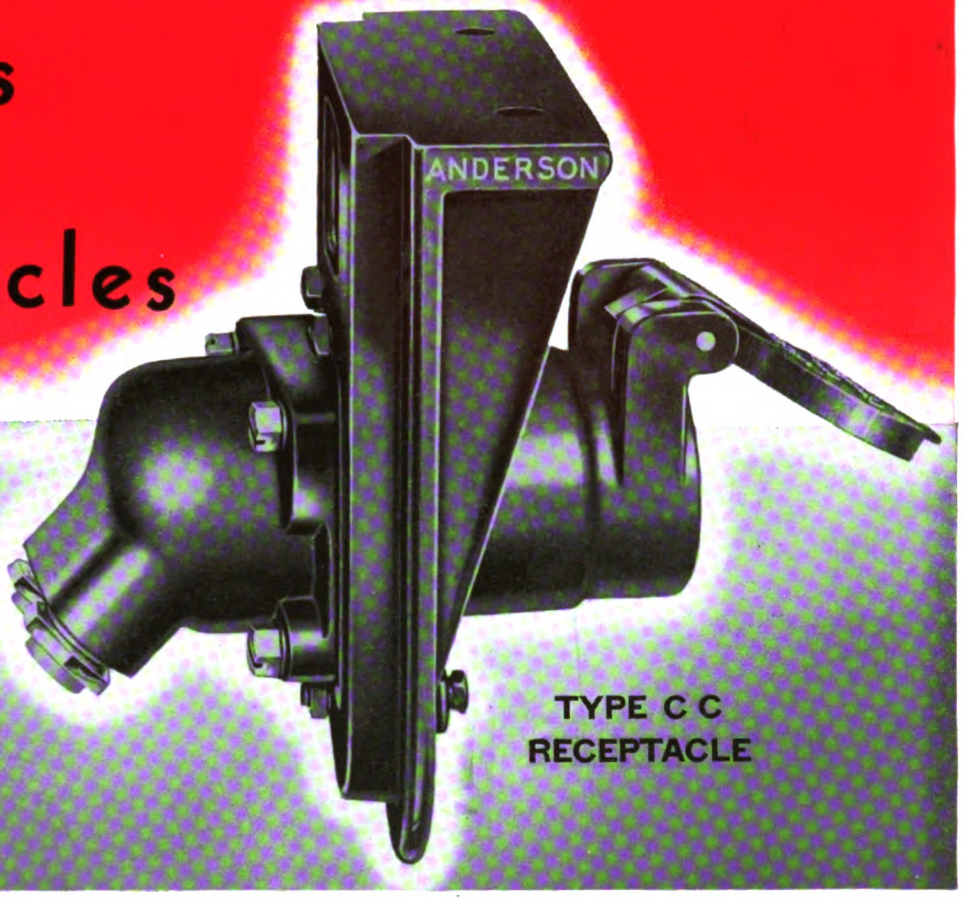
PIPE THREADING MACHINES.—The Oster Manufacturing Co., 2057 East Sixty-First street, Cleveland 3, Ohio. Four manuals: No. 300 Series—Pipe and Bolt Threading Machines; No. 422—Power Vise Stand; No. 502—"Pipe Master;" and No. 562—"Tom Thumb." The No. 300 Series are stationary machines; the other machines are portable. Each booklet divided into three sections—an operator's manual, a maintenance manual, and a spare parts list.

◆

GEAR-MOTORS.—General Electric Company, Schenectady, N. Y. Sixteen-page illustrated bulletin. Describes the many types of GE gear-motors, lists their advantages, and indicates the various locations where their use is most desirable. Contains also descriptions of the mechanical features of these motors, the electrical characteristics of the polyphase motors which are integrally built into them, and charts showing their horsepower-speed ratings.

Anderson

Plugs and Receptacles



TYPE C C
RECEPTACLE

Anderson Plugs and Receptacles are designed for the following:

- Air Conditioning
- Battery Charging
- Marker Lights
- Yard Receptacles
- Platform Receptacles
- Portable Tools
- Telephones
- Switchboards
- Welding
- Cable Connectors
- Couplers
- Watertight Plugs and Receptacles
- Turntables
- Industrial Trucks



MAINTENANCE TODAY?

Now that you must rely on help today that is less skilled, watch how Anderson Plugs and Receptacles on the cars and in the yards stand up to the rough and tough usage.

The know-how and the sturdiness built into Anderson material of yesterday is showing its real value today as it will continue to do, years hence.

Designed and constructed specifically for railway work you can always depend on Anderson for the absolute minimum of trouble and maintenance—and that means something today.

ALBERT and J.M. ANDERSON MFG. CO.

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ARE YOU?

● HE is our Army, Navy and Marines. The job they are doing is bringing us closer to a "peace-work" job, faster than we had dared hope for. Peace, when it comes, lasts for only a few minutes of whistle-blowing and bell-ringing. This is the signal for American business to take the ball and score—or (pray, no) fumble and stumble in a muddle of our own making. HIS clear sights are pointed to the green lights of all-out peace-time production and prosperity. American bombardiers are "on target". Are you? Call your shots, Mister Businessman. Call on LeBlond NOW for improved turning equipment.

THE R.K. Le BLOND MACHINE TOOL CO., CINCINNATI, 8

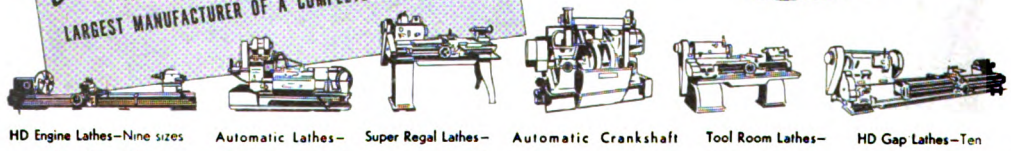
NEW YORK 13, 103 Lafayette St. CAnal 6-5281

CHICAGO 6, 20 N. Wacker Dr. STA 5561

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HD Engine Lathes—Nine sizes ranging from 12" to 50" swings. For versatility in turning

Automatic Lathes—12" & 16" Mechanical or Hydraulic power

Super Regal Lathes—Six sizes, 13" to 24" Best for training

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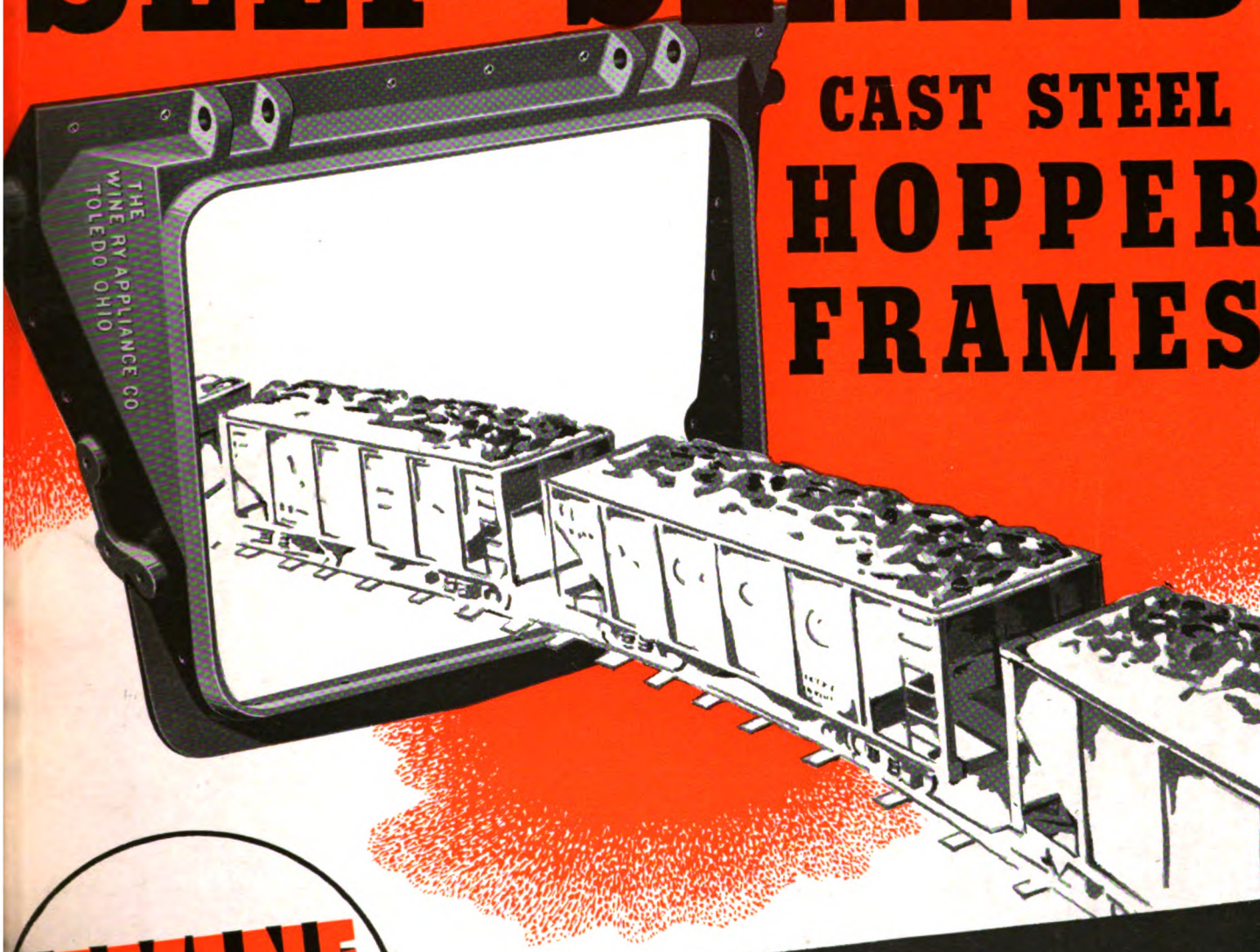
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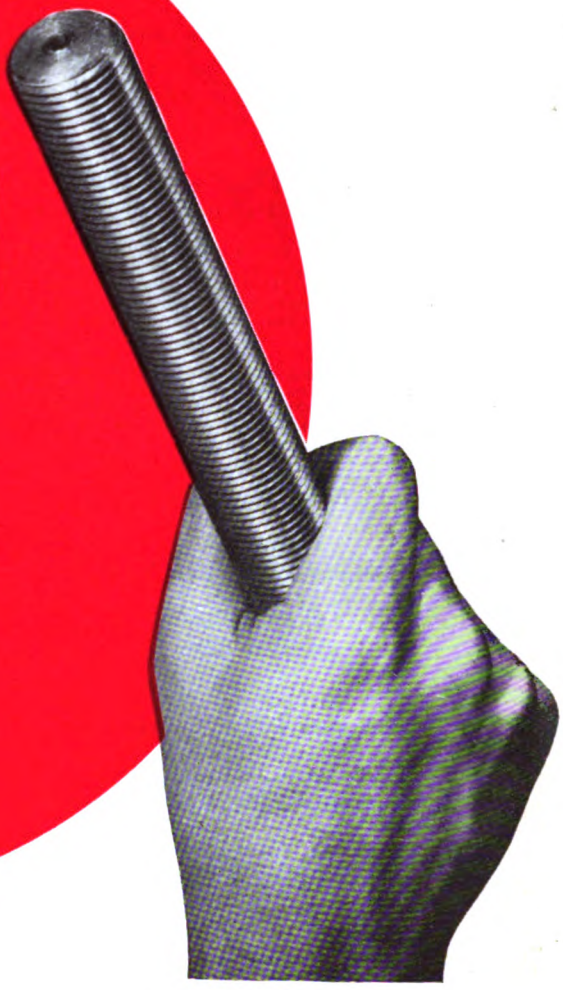
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Again—Conventions in Print

THIS issue, like that of November, 1942, is a "convention in print." The name, indeed, applies even more appropriately this year because the fields of five associations are dealt with in its columns, whereas last year there were but four. The newcomer is the Electrical Section, Engineering Division, Association of American Railroads. This is the second year in which the Coordinated Mechanical Associations have been unable to hold their regular annual meetings because of the pressure of wartime conditions. The high state of the morale of the officers and members of these associations is attested by the fact that for the second year in succession three of the four—the Railway Fuel and Traveling Engineers' Association, the Master Boiler Makers' Association, and the Car Department Officers' Association—have made regular committee assignments for reports on matters of method and practice and on problems of administration. A high percentage of these reports have now been prepared notwithstanding the fact that many of the committees have been handicapped by inability to hold meetings and have had to conduct their business by correspondence. These reports will be placed in the hands of the members of the associations in the customary year books. But the material in them is of interest to a much wider audience than the members alone. In order that the entire field may have the benefit of the work which the officers and committee members have done, at no small sacrifice of personal time and energy, we here present the meat of these reports. The Electrical Section, too, has proceeded constructively with its committee work, even though it does not meet this fall, and six of its reports will be found herein. The fourth coordinated association—the Locomotive Maintenance Officers'—decided against continuing work on committee assignments for this year but sponsored a forum discussion of six timely questions pertinent to present conditions in locomotive shops and engine terminals. In these pages, then, we offer our readers the opportunity to attend "conventions" of five associations which deal with various aspects of their interests.

Nine Reports from

Traveling Engineers' Association



L. E. Dix,
President

J. Duff Smith,
Secretary-Treasurer



"Convention in Print" covers full range of subjects, reports on which will appear later in the year book of the association

FOR the second year in succession the Railway Fuel and Traveling Engineers' Association has carried on its full year's quota of committee work just as though it were to culminate in the presentation and discussion of the reports at the customary annual meeting. This has been done in the face of increasing difficulties caused by the growing pressure of inadequate manpower and heavy traffic movement.

There are eight committee reports and one paper on the program, which, except one, are abstracted in the pages immediately following. These deal with fuel selection, steam locomotive firing practice, the utilization of steam motive power, and Diesel locomotive operation. There are also reports on the "combustion chain" of the steam locomotive and on refinements in fuel statistics and an individual paper on the recent modification of the AB brake for use in fast-freight service. The report on Gas Turbine Locomotives will appear in a later issue.

Because of the absence of the annual meeting, no election of officers can be held. The officers elected at the annual meeting in 1941, therefore, continued in service. These are President: L. E. Dix, fuel supervisor, T. & P., Dallas, Tex.; vice-presidents: E. E. Ramey, fuel engineer, B. & O., Baltimore, Md.; W. C. Shove, general road foreman of engines, N. Y. N. H. & H., New Haven, Conn.; secretary-treasurer, T. Duff Smith. The members of the Executive Committee are E. Holmquist, master mechanic, C. & N. W., Chicago; A. G. Hoppe, assistant mechanical engineer, C. M. St. P. & P., Milwaukee, Wis.; H. W. Sefton, superintendent locomotive and fuel performance, C. C. C. & St. L., Indianapolis, Ind., and W. R. Sugg, general supervisor of air brakes, Mo. Pac., St. Louis, Mo.

A Statement by the President

Adhering to the policy adopted for the duration by the various railroad associations we again suspend our annual convention in the hope that in 1944 the emergency will have passed and we can then get together and reap the benefits which are best produced by contact and discussion of the problems which are confronting us.

Since our last report to the Association we have progressed well into the second year of our total war—a war which is total in all its aspects, none more clearly defined than the demand upon the railroad industry to handle an unprecedented volume of traffic, both freight and passenger. That these demands have been met by the railroads of the United States is attested by the fact that during the past year there has been moved without serious congestion or interruption by far the greatest volume of traffic ever handled in any comparable period and this has been accomplished not with as many or more units of equipment, but actually with less—a lesser number of locomotives and cars in both classes of service.

In these accomplishments the Association has played a vital role as the success of the railroads in meeting every demand made upon them has been due in no small measure to the application of practices and principles advocated by it. With other industry devoted practically one hundred per cent to war production and the manufacture of equipment and materials essential to their proper operation and maintenance reduced to absolute minimum, it has been necessary that the railroads make what they have last to an almost incredible degree and this, too, has been achieved with an amazingly small loss of utility.

Obviously the gigantic task imposed upon the railroads has created conditions requiring many deviations from past practice. Among these has been greatly increased locomotive mileage in which we have had an important part as there is no single factor more directly essential to this increased service mileage than the proper and economical operation of the locomotive which is the prime objective of our organization.

During the emergency thus far many obstacles have been overcome without serious operating difficulties; many readjustments to unfamiliar types and grades of fuel, both coal and oil, some of which, no doubt, has been inferior to that formerly available and used; the training and educating thousands of new employees in engine service which in itself is a most important step looking to the selection of men who will be qualified some day to carry on, not only on the individual lines but the activities of this and other related associations.

While the burdens of unusual traffic demands have created some conditions which produce unfavorable effects upon fuel performance it is gratifying to note that increases attributable to causes other than the expanded service requirements have been very slight which is testimony to the untiring efforts of the members of the Association to maintain, and even improve the records in this respect notwithstanding the handicaps.

Although our meetings have been suspended and contacts greatly curtailed during the past year while we have done our bit in the paramount task of bringing about a victorious end to the war, the affairs of the Association have received attention, and while being deprived of the advantage of debate and discussion we can all avail ourselves of the many excellent papers appearing herein.

Firing Practice on Coal-Burning Locomotives



W. C. Shove,
Chairman

Getting the fire ready for the trip—Care required in stoker-firing slack coal

In view of the fact that within the past two years it was necessary to bring into locomotive service several thousand inexperienced locomotive firemen, various educational methods have been employed by the railroads. This committee believes that the best results are obtained where student firemen, after being placed on the spare board, are supervised by competent instructing firemen until such time as it was felt they are capable of handling various classes of service alone, a record being kept of each individual fireman, showing the number of trips under supervision before competency is established, and where such records show a specific student fireman is receiving more than the ordinary number of trips, the road foreman or supervisor takes the man in hand in an endeavor to determine if he will ever meet the requirements demanded of a locomotive fireman.

Some benefits have also been derived by placing student firemen on the ash pits a sufficient time for them to become familiar with grate shaking devices, methods of cleaning fires and bedding them down after having been cleaned.

The first essential in line with firing practice is the preparation of the locomotive for service. Firemen should report to the terminal in sufficient time to make a systematic inspection of the fire condition, grates and tool equipment. After trying out the stoker to see that it is operating properly before leaving the terminal, the fire should be maintained in the terminal with the shovel. However, fires can be maintained with the stoker, proper attention being given to the distribution of the coal.

At the time of leaving the terminal, the fire should be in a level, bright condition so there will be no rapid drop in steam pressure. Frequent observation of the fire condition is necessary to know that no banks develop. On stoker-fired locomotives the stoker should be shut off a sufficient length of time for proper inspection of the fuel bed. Firemen should keep a close watch on the steam gauge as well as stack smoke densities. Where the boiler pressure is nearing the maximum, fuel supply should be reduced enough to control the boiler pressure. At such a time it is good policy to inspect the condition of the fuel bed. Following such procedure the fireman should always know definitely the condition of the fire.

At points enroute where stops are made and the fire is building up ash to a depth that will interfere with sufficient air coming through, the grates should be lightly shaken, then or soon after; it is felt by many the proper time to shake grates is after the locomotive has accelerated to the point where the running cutoff has been reached, which gives a better result than shaking while standing and a start made immediately after. Unnecessary use of the fire hook or slice bar should be avoided.

It was felt by one railroad that the showing of the motion picture "Three Atoms" developed by the Baltimore & Ohio a number of years ago, has a very definite effect upon our student firemen.

Within the past several months preparations of fuel on many railroads has not been up to standard and it has been necessary to burn considerably more slack or fines in this coal.

Burning More Slack

The following is taken from a report used by the Reading with very good results:

Intensified efforts are being made to mine enough coal to supply our expanding war efforts and the most conspicuous evidence we see of this is more slack in our bituminous coal. The miners say they cannot produce enough coal to keep the railroads and other war industries going if they have to furnish the same high percentage of lump coal that we formerly received.

Furthermore, in the process of unloading from railroad cars and placing it in coal pockets, the lumps may become separated, going to one side of the pockets with the slack going to another, and by this you can readily see some tenders will be loaded with an excessive amount of slack. Some men, when they get a tank load of this kind of coal, especially on a stoker-fired engine, look for trouble, feeling sure they will have a banked fire.

This is not necessary. The fireman knows that with slack coal he must use more care with the adjustment of the steam jets and in the regulation of the coal feed, and this is the most important single thing in the successful use of slack coal. He must know the condition of the fire at all times by frequent observation so that these adjustments can be made intelligently to prevent or correct irregular feeding or burning of the coal. If he fails to make these adjustments until the steam pressure drops, then it is usually too late—the pile is there.

The fireman must watch all signs of impending trouble, such as the color of exhaust from the slack, steam gauge, the color and action of the flame, the flow of coal

at the crusher and, not the least, he must be alert for signs of stoker defects. These things will give him warning of trouble in time to make the necessary adjustments to jets and feed to prevent the troubles that are sure to follow if not done.

Reports of all delays due to steam or fire trouble indicate that two things cause firemen more trouble than any others, i. e.,

1—Poor distribution of coal, very often due to failure to make adjustments in time.

2—Feeding more coal to the firebox than the engine will burn.

When the steam pressure begins to drop, it is a human tendency to increase the feed of coal. Don't do it. First examine your fire; it may be due to a pile or to a hole in the fire in which case increasing the feed will only make matters worse. What is needed is better distribution and this can be gotten by adjusting jets or feed and often by adding a few scoops of coal by hand. Do not increase the feed until you know by observation that the fire is too light.

See that your fire is clean before leaving the terminal. Get it burning all over and through by use of blower and scoop. Start the stoker carefully and know the condition of your fire at all times. That is very important with any coal—but most important when using slack. Keep the fire level and as light as you can and maintain steam pressure. Do not use a heel or permit banks or piles and keep the fire burning all over. Do not feed more coal than will burn.

Follow the advice herein as being the best way to avoid clinker trouble and steam failure when using slack coal. If you have any doubts about this being the best way, tell your road foreman or traveling fireman. They are more concerned than anyone else in having you get over the road without steam trouble; therefore, it is only common sense to consult them first if you have any doubts, or trouble with your fire.

Please keep in mind that war conditions require for the present that we use more slack coal than formerly; this is something beyond our control to remedy. Let us use care so that we can burn it successfully, thus saving ourselves hard labor and avoiding train delays.

If you note any stoker defects, or have experienced any irregular operation, be sure to report it on the work report. A good stoker makes the job easier.

The report was signed by W. C. Shove (chairman), general road foreman of engines, N. Y., N. H. & H.; W. E. Beaver, general road foreman of engines, Southern; O. L. Dean, mechanical superintendent, Bangor & Aroostook; C. Harding, road foreman engines, L. & N. E.; W. E. Small, B. & M.; F. X. Jones, supervisor fuel and locomotive operation, Erie; W. D. Quarles, general mechanical instructor, A. C. L.; J. H. Simmons, N. Y. C.; H. Morris, superintendent fuel and locomotive performance, C. of N. J.; S. M. Roth, supervisor locomotive performance, Western Maryland; G. B. Curtis, assistant road foreman engines, R. F. & P.; W. R. Sugg, general supervisor air brakes, Mo. Pac.; W. E. Sample, assistant superintendent fuel conservation, B. & O., and A. Baxter, general road foreman equipment, D. & R. G. W.

Training Firemen for Oil-Burning Steam Locomotives



E. G. Sanders,
Chairman

Western oil-burning roads find new firemen hard to get—Inexperienced supervision handicaps their training

The unprecedented volume of traffic now being handled by all railroads due to the war has necessitated employing a great many inexperienced men for locomotive firemen. A large number of the experienced firemen have enlisted or been drafted into the armed forces, and in addition, nearly all of the experienced firemen who have been promoted to engineers are now running locomotives. All of this has resulted in having to man the locomotives with inexperienced firemen.

On the oil-burning railroads traversing the sparsely settled desert country in the west and southwest, it has been difficult to get men to accept employment as firemen due to the shortage of housing accommodations. With the serious shortage of firemen existing in this part of the country, the training of student firemen has been a difficult problem. Many instances have been reported where a student fireman would make a trip with a fireman performing his first pay trip after being qualified. Obviously, the student fireman would have little opportunity to learn anything about the correct method of firing a locomotive.

Previous to the war, the railroads were able to select the men hired as new firemen. It was the usual practice to require that an applicant for the position of fireman should have at least a high-school education, and whenever possible, men were selected who had previous experience working in locomotive shops and roundhouses. Under present war conditions, the problem confronting the oil-burning railroads in the west and southwest is to be able to employ a sufficient number of firemen to man the locomotives. Education and other desirable qualifications are of secondary importance.

Fuel supervisors, road foremen of engines, air-brake supervisors and other traveling supervisors who ride locomotives have a very great responsibility training and instructing new firemen. It is important that the men selected for supervisors be well qualified to train and instruct firemen.

Supervisors should ever keep in mind the fact that a great many of the new firemen have not been properly instructed or received adequate training before being assigned as firemen. It will be found that many of them, through no fault of their own, will have acquired incorrect methods and practices of firing oil burning locomotives. It requires a great deal of patience and effort on the part of the supervisors to train and instruct firemen who have learned to fire improperly.

A great many of the new firemen will remain in railroad service as firemen after the present war emergency is over. On how these men learn to fire a locomotive in the early months of their employment depends whether they become good or poor firemen, and in later years whether they are good or poor enginemen.

Under present conditions, it is not possible to provide enough supervision to train new firemen intensively to the extent that would be desirable. Many of the younger supervisors have had very little experience in supervisory work. Much coaching is required on the part of the master mechanic and the older supervisors. It is essential that young or inexperienced supervisors be trained how to instruct new firemen. It is the duty of the master mechanic and senior supervisors to give such necessary training and instructions to the new supervisors before they are assigned to train and instruct new firemen. Knowing how to fire an oil-burning locomotive properly does not necessarily mean that a man will make a good supervisor to train new firemen. Very often the best fireman on a division will make a poor supervisor, for the reason that he does not have the ability to impart the knowledge he has to the new men. Too much care cannot be exercised in the selection and training of supervisors.

Members of this Association from oil burning railroads are cordially invited to comment on this report and it is hoped that they will advise how the training of new firemen has been handled on their railroads.

The report was signed by E. G. Sanders (chairman), fuel conservation engineer, A. T. & S. F.

Utilization of Steam Motive Power



A. A. Raymond,
Chairman

A discussion of the problems of servicing locomotives on long runs without undue delay

A study of the use of locomotives can perhaps be made along the following lines:

1.—Will the machinery of a locomotive stand up under intensive utilization.

2.—Continuing a steam locomotive in service requires a renewal of the water and coal supply or larger tenders, and dumping of ash pans or some means of increasing ash pan capacity.

3.—Will present operating conditions permit or allow the standing time that is necessary to take coal, water and dump ash pans or should facilities be provided even at considerable cost to reduce this time to a minimum.

Mechanical Reliability

The literature of the Railway Fuel and Traveling Engineers Association, the reports of the Association of American Railroads Mechanical Division, The Railway Age and many other reports, talks before Railroad Clubs, etc., show that the modern locomotive has great reliability and that high mileage, so far as the machine is concerned, can be expected. This, it appears, follows experience with modern machinery which has become increasingly reliable.

Attached is a chart of the utilization of locomotives on all Class One railroads and it will be observed that the use of passenger engines is increasing steadily with freight showing some increase and switch little change.

Engine failures on long through runs, that is, per cent cut outs, varies, but in general the reliability is high with 4 per cent on one large system.

So it seems reasonable to assume that the locomotive, if properly maintained, can and will supply even greater percentage of utilization if other factors can be arranged to keep refueling delay, for instance, at a proper figure.

Servicing Facilities

Water

Where a passenger locomotive uses possibly 100 gallons per mile and a freight locomotive 200, water builds up in weight so rapidly that for long through runs it seems necessary either to scoop water or to provide large enough water plugs *at regular stops* so that the tender or auxiliary tank can be filled in not over three minutes during the time of a regular station stop or while changing crews. Thus a 100-mile division passenger run requires at least 10,000 gallons weighing 83,000 lb. and the freight run will use 20,000 gallons weighing 166,000 lb. which, with a necessary reserve of 5,000 gallons would seem to indicate that 10,000 gallons of water must be taken in three minutes by a passenger locomotive every 100 miles with correspondingly larger freight tenders or more stops. If division non-stop runs of 150 or 200 miles are to be made, of course the tender must be proportionately larger.

Coal

Assuming a passenger engine making 20 miles per ton and a freight 10 miles per ton, a 900-mile run can

be made with 45 tons. Adding a bad weather or train-late margin of about 70 per cent we get a total of 75 tons. The decision must be made as to how often a coal stop can be made, where it can be made and what time will be allowed.

Forty-two tons can easily be put on a locomotive tender in 75 seconds with a modern coaling facility, but the time slowing down and accelerating may stretch out the lost time to 7 or 8 minutes, if this is a special stop.

If coal can be taken at a regular stop or at a crew-change point the time element does not enter. A coaling plant in a passenger station is not desirable (except small ones for emergency coaling). Furthermore, a plant large enough and covering enough track to coal several trains in a few minutes would be very expensive; a tender that will only require one stop seems desirable.

Freight trains on through runs should have an auxiliary coaling plant on at least two tracks where a train not requiring switching can be coaled while cabooses or crews are being changed and where locomotives can readily receive coal and water if the train requires switching. In the latter case the facility should be located so that the locomotive will not interfere with yard movements.

Ash Pans

It is found in through passenger service that ash pans of ordinary capacity require dumping at about 250 miles. The dumping and cleaning take considerable time. It is recommended that serious study be given to using the space left as coal is used up in the larger tender through a series of conveyors, as an auxiliary of the main ash pans. In this case it would be possible to run long distances without stopping for ash-pan cleaning.

This again is primarily a matter of time and secondarily of place. Passenger stations are hardly a good place to dump pans, although undoubtedly an ash handling plant could be made practically dustless (although expensive).

The above discussion has all referred to passenger and freight service, but substantial savings can be made if switch engines are worked more intensively and this can be done by providing several auxiliary coal, water and ash handling facilities near where the engine can be stopped while the crew eats lunch. Such location, to be of value, requires careful study and with a proper control of smoke and ashes can be used in most places without causing trouble in the neighborhood.

The report was signed by A. A. Raymond (chairman), superintendent fuel and locomotive performance, N. Y. C.

Front Ends, Grates, Arches and Ash Pans



J. R. Jackson,
Chairman

The report suggests need of a study of gas flow to determine tube sizes which will not plug

It has been and is generally accepted practice in making evaporative and efficiency tests of locomotive boilers to install U-tube draft gages in the smoke box, superheater-header, combustion chamber, fire box and pan, possibly providing two or more gages in the smoke box to register ahead and behind netting or plates and in the fire box under and over the arch. The records of these gages are in inches of water, one inch being equivalent to a pressure of 0.036 lb. per sq. in. In the combustion train of a conventionally drafted steam locomotive boiler, the drafts, with the possible exception of that in the pan of a coal-burning locomotive, are all less than atmospheric pressure or vacuum, ranging from maximum vacuum in the smoke box and progressively increasing to atmospheric pressure at the air openings into the pan. The difference in draft pressure between points in the path of flow through the fire box and boiler, temperature of the gases, area of the gas passages and resistance in the path of flow, determines the volume of flow at that point.

The products of combustion coming through the fire bed of a coal-burning locomotive and from the combustion zone of an oil- or pulverized-coal-burning locomotive will take the path of least resistance in their passage through the fire box and into and through the flues and tubes headed for the smoke box. The temperature, direction and rate of flow of heat through the fire box, flues and tubes is what makes for free steaming and the continuance of this condition over long periods of time is what makes for satisfactory and economical operation. Experience has indicated that the distribution of the flow of heat through the boiler is essential to economical and trouble-free operation and that the provision and maintenance of a relatively close balance between the component parts of the combustion train is the secret of satisfactory road performance.

The energy in the exhaust to atmosphere from a steam locomotive is very considerably more than sufficient to draft the boiler. Over drafting is decidedly a possibility with a front-end arrangement having relatively large jet surface areas, stack areas and high volumetric efficiency for the movement of gases through the boiler. A condition of excessive draft is as bad as insufficient draft as regards development of boiler power on the road. The over-drafted condition, however, has the disadvantage of excessive fuel consumption without adequate return in water evaporated or steam superheated, whereas with the under-drafted condition it is impossible to burn sufficient coal to develop the desired power. The over-drafted condition obviously results in the induction of excessive air for combustion, the lowering of the temperature of the gases and excessive volume and rate of flow over the evaporating surfaces. No inconsiderable portion

of the energy of the exhaust jet is utilized to properly elevate the products of combustion above the train in motion and there is a practical limit to relatively large stack areas in combination with the conventional nozzle design beyond which it is inadvisable to go for the reason of the lower velocity of discharge which makes for trailing smoke.

The heavy traffic and limited power situation on the railroads during the past year has made it necessary to utilize available locomotives to the utmost and emphasizes the fact that the limiting factor on coal-burning locomotive availability from a servicing standpoint is the necessity for periodically blowing the flues. Twenty years ago the necessity for both frequently washing boilers and blowing flues kept locomotives in terminals for extended periods but the improvement in boiler waters and the general practice of conditioning boilers by terminal and on-line blowing has practically eliminated the water problem as it effects utilization, whereas the necessity for holding locomotives for blowing flues continues to be the limiting factor as to the mileage that can be made before engine-house attention and as to the time necessary to service locomotives at terminals.

Much is heard about cinder cutting of units and flues on coal-burning locomotives, which condition, of course, is related to gas velocities and the character of the fuel supply. As the gas area through the flues is decreased progressively by stoppage, velocity and cinder cutting increase. Equalized gas flow through flues and tubes is important and extreme draft fluctuations are to be avoided.

In the realm of increased steam locomotive utilization, particularly coal-burning locomotives using grades of coal which are regularly available in different parts of the country, a question relating to the proportion of evaporative and superheating surfaces and gas area restrictions in the original design presents itself. The question is should not the tubes, flues and superheater unit be proportioned to insure adequate over-all boiler capacity and efficiency over a longer period of operation rather than ideal efficiencies over shorter periods of operation? In other words, would it not be better to have all of a lesser number of flues and tubes kept open all of the time rather than experience flue stoppage in flues of restricted gas area after relatively short service?

A study of the paths and velocities of air intake and heat flow through a locomotive boiler should add materially to the knowledge of drafting for both economy and availability. With the instrumentation available after the war it should be a possibility in the field of research to study this temperature-flow relationship which could not only be expected to yield valuable information in drafting the boiler from the standpoint of establishing the most economical combustion-train relationship for a given fuel but also to throw light on the practical problems of cinder cutting and control of slag formation.

The report was signed by J. R. Jackson (chairman), engineer tests, Mo. Pac.; H. D. Green, Nor. Pac.; H. L. Malette, road foreman of equipment, St. L.-S. F.; A. A. Raymond, superintendent fuel and locomotive performance, N. Y. C.; W. E. Small, B. & M.; S. R. Tilbury, fuel supervisor, A. T. & S. F.; L. W. Withrow, C. & O., and E. G. Young, University of Illinois.

The Road Foreman and Diesel Locomotives

Enginemen must be taught correct starting and transition procedure to protect the locomotive against damage



W. D. Quarles,
Chairman

In cases where our Diesel operations are pooled and an engineman operating a freight Diesel is called to fill a vacancy on one of our passenger locomotives, it is necessary that he thoroughly understand the difference in the operation of the controls on the two type of locomotives. He may carelessly subject the locomotive to harmful abuse that will, if not at the instant, set up a weak condition which on a later date may cause a failure and possible delay to a train.

The road foreman of engines should continuously keep the engine crews conscious of knowing and understanding the fundamental operation of Diesel-electric locomotives. The fuel-oil tanks, lube-oil tanks, engine cooling systems and the boiler-water tanks should be known to have sufficient supply for the trip ahead. In starting the diesel engine the proper procedure should be followed regardless of time element. The present instructions as issued by the manufacturer in regards to starting the engines is to "Test for cylinder liquid accumulation with test valves open and isolation switch in 'start' position. Rotate the engine once or twice by hand using the engine turning bar. If liquid is noted at test valve do not start the engine until the cause of the discharge is removed."

It has been the practice on most roads to open the cylinder test valves and then push the engine "start" button and thereby rotate the engine to test for liquid accumulation. The current flow may reach a value of 1,400 amperes at the instant the starting contactors close and if a good contact is not made, or the "start" button is jabbed, the current flow is interrupted and high amperage will cause destructive arcing at the contactors, shortening their life and even welding the contactors closed. Instill in your men the necessity for making good contact to prevent arcing and consequent damage to contactors and interlocks. After the test valves are

closed it is important that the auxiliary generator disconnect switches in the low-voltage cabinets of the engine that is running be opened in order to prevent blowing of the battery charging fuse. The next procedure is to start the fuel pump and after pressure is built up as indicated on the gauge, press the "start" button and hold until the engine speed recorded on the tachometer reaches 150 to 200 revolutions per minute. By holding the starting contactors closed until the engine starts and runs, the starting current will reduce and, when the contactors do open, is of such value that arcing is minimized.

After the diesel engine has been started the main bearing and piston cooling lubricating-oil gauges must be observed. An inspection should be made at this point to determine if the contacts on the ground protective relay are closed. It has been found that thin relay 'kicks out' when the main generators are motorized in starting the engine at times due to grounds on the low-voltage system.

Before the Diesel locomotive leaves the hostler's track at the initial terminal a thorough brake test should be made to determine the proper setting of the feed valve and that the brake system reacts in accordance with the operation of the independent and automatic brake valves. The initial test should be made with the Diesel units alone to test for leakage and proper operation due to the possibility of crossing of pipes between units. If by chance the actuating and the independent application and release pipes were crossed it would result in possible damage to the wheels. When the brakes are set with the automatic brake valve a test should be made to accomplish an independent release.

The road foreman should impress upon the enginemen the necessity of making a thorough inspection of the running gear so that improper shoe clearance or fouled brake rigging may be corrected at terminals and thus avoid delays on the road.

The engineman controls the speed of the Diesel engines with the cab throttle or controller. The actual control of the engine speed is, of course, effected by a governor mounted on the front of the engine and what the engineman actually controls is the governor demand. On a switching locomotive, using only one Diesel engine this demand is accomplished by a system of rods and levers connected between the cab controller and the governor. On passenger, freight and transfer locomotives, where several engines in more than one unit must be controlled by one throttle handle it is out of the question to use the same system of rods and levers. Instead the several governors are controlled simultaneously by the electropneumatic governor control, more commonly called the "grasshopper."

This device mounted on the engine next to the governor consists of four air cylinders and a system of levers which transfers the movement of the air cylinders to the governor. The air cylinders are actuated by magnet valves, one mounted on top of each cylinder, and the cab throttle handle moves a contact surface that connects the magnet valves in combinations to give the desired Diesel engine speed to correspond to the position of the cab throttle. The wiring to these magnet valves runs the entire length of the locomotive.

Most Diesel-electric locomotives use the "soft start," which means that the exciting current of the main generator is at the lowest value. This exciting current is controlled by a load regulator, a device that is operated by the engine governor. In starting a heavy train the engineman advances his throttle from idle position to Run 4, pausing a matter of two to three seconds between notches. This pause is necessary since each notch above Run 1 causes the Diesel-engine speed to increase in steps of 75 r.p.m. and time must be allowed for the engine to assume the new speed before advancing to next notch. During this advance the load regulator begins to move from minimum excitation to maximum excitation. This movement requires from 12 to 25 seconds, depending on the type of load regulator used, and the train should begin to move. At the start the electrical connections between the main generator and the traction motors are such as to give the traction motors a maximum amount and thus provide the heavy torque of turning force necessary to start the train. The engineer then advances his cab throttle, speeding up the Diesel engines, but the pause between each notch should be from 4 to 6 seconds. The load regulator, once the load has been applied to the Diesel engine, has a definite function of protecting the engine against over-loading. Hence the pause between throttle positions is increased to allow this device to function.

The practice on most roads, when the locomotive is standing at terminals and the engineman is not in the seat, is to leave the throttle in idle position, the reverser in neutral with the handle removed and the generator field switch out. This is to guard against leaving power applied to the motors while standing and prevent damage to equipment as well as to guard against the train moving off if the brakes were released and controls positioned for power.

It has been found at different times that the engineman, on preparing to start train, overlooked the fact that the generator field switch was out and opened the throttle to Run 4 with no result. He then noted that this switch was out and there have been instances of the engineman pushing in the switch with the throttle still in Run 4. By this time the load regulator was either in maximum field excitation or approaching it, and under these conditions power is suddenly applied with considerable force, enough so as to cause damage to gearing, electrical equipment and the train itself. The crews should be instructed that if such a condition is noted, the throttle must be closed off at proper time interval to idle position, the switch closed and ample time allowed to permit the load regulator to return to minimum field excitation before again opening the throttle. This should be accomplished in from 12 to 25 seconds depending on the type load regulator involved.

As the train speed increases, it reaches a point where the turning effort of the traction motors balances with the current flowing and in order to get more speed it is necessary to change the electrical connections. This changing of the connections is called transition. On passenger locomotives this function is automatic while on freight locomotives it is done by the engineman. During transition a lot of things take place within a very short space of time. The transition relay closes and in so doing causes the main generator shunt field contactors to open. The shunt field contactor opening causes the battery field contactor to open and when this contactor opens it unloads the main generator and also closes a circuit to the time delay relay. After a split second the time delay relay closes and establishes a circuit that closes the first parallel contactor. Interlocks on this contactor open and that drops out the series contactor. When the series contactor opens it sets up a circuit which closes the second parallel contactor. The second parallel contactor opens interlocks that de-energize the transition relay which now opens and allows shunt and battery field contactors to close and load up the main generator again. In case of failure of any of these various steps

transition stops and the power plant remains off the line until the trouble is found and corrected. This is a safety feature preventing damage to the generator and traction motors through wrong electrical connections. A knowledge of this sequence enables the crew to quickly locate and remedy the defect, returning the power plant to the line.

The position of the load regulator should be noted from time to time while locomotive is under way as a check on proper loading. For istance, if load regulator arm is all the way over in maximum field excitation, and the load indicator mounted adjacent to the governor below the grasshopper shows that the engine is only partly loaded, with its speed maximum, then there is definitely electrical trouble. A check should be made to determine if the shut-field and battery-field contactors are closed. If they are then check the 60-amp. battery field fuse or the load regulator itself for brush trouble or bad electrical connection. Also check for auxiliary-generator battery-charging fuse blown, loose belts on generator or a generally weak battery. If the contactors mentioned are open look for bad electrical conection at the ground relay contacts, wheel-slip relay contacts, or a starting contactor interlock open or making poor contact. The trouble can usually be located at one of these points.

On the other hand, if the load regulator is in minimum excitation area and the load indicator shows an overload, the trouble is mechanical. Check the engine for proper fuel supply, an injector not firing or mis-firing, poor compression due to broken or stuck valves, or blow-by at piston rings.

Lube-oil and fuel-oil pressure gauges should be observed. Likewise the lube-oil tanks should be checked to watch for fuel oil or water dilution. Such dilution going un-noticed can result in engine damage that would cause not only a loss of power through losing that power plant but may result in a locomotive being tied up at maintenance point for extensive repairs. Traction-motor blower-fan belts should also be checked en route. A few minutes spent periodically while the locomotive is running will pay big dividends in preventing costly repairs and lost mileage.

The report was signed by W. D. Quarles (chairman), general mechanical instructor, A.C.L.

Refinements in Fuel Statistics Move Ahead



E. E. Ramey,
Chairman

Committee on Fuel Records and Statistics collaborates with committee on statistics of the accounting division

The Committee on Fuel Records and Statistics reported on two questions on which it has been collaborating with the Committee on Statistics of the Accounting Division, Association of American Railroads. The first has to do with the incongruity of the figures for the quantities of fuel and power used, respectively, by the several types of motive power in road service as reported by the I.C.C. Bureau of Transport Economics and Statistics on Statement No. M-230 (OS-E), and the car-miles reported by the type of trains based on the kind of fuel burned by the principal locomotive as reported on Statement No. M-213 (OS-B). The second relates to the use of "statistical equivalence" of the respective fuels based on relative results obtained in service in the production of gross ton-miles, passenger-train car miles and switch-engine hours in establishing the factors to be applied in converting other fuels and power to terms of pounds of coal, rather than the thermal equivalents of the respective fuels.

With respect to the first subject, the committee pointed out that where locomotives burning one type of fuel perform helper service on trains hauled by locomotives using another type of fuel, the fuel used in helper service is accumulated against the type of service performed by principal locomotives burning that type of fuel. Thus, in a case cited in the report, the performance figure per passenger-train car-miles moved in trains hauled by Diesel locomotives was 0.288 gallon, based on the present method of reporting car-miles and fuel consumption, whereas when the fuel consumed by steam locomotives helping trains hauled by Diesel-electric locomotives was added, the unit consumption increased to an oil equivalent of 0.313 gallon. The figures based on the present method of reporting are 8 per cent lower than if the coal used in helper service is charged to the train-service hauled by Diesel locomotives and the unit fuel consumption in steam-train service is unduly high by having the coal used in Diesel-helper service charged against steam-train operation.

The committee of the Railway Fuel and Traveling Engineers' Association also took up with the Committee on Statistics of the Accounting Division the question of adding an item to the OS-E form to provide for reporting equated pounds of coal (all road passenger service) per 1,000 gross ton-miles, including locomotives and tenders. It further proposed the addition of items to Forms OS-A and OS-E to provide for the entry of the Diesel locomotive in freight service.

The Committee on Statistics of the Accounting Division expressed the opinion that some suitable adjustments to overcome the incongruity of the unit fuel consumption figures when a different type of fuel is used by the principal and helper locomotives should be made through the medium of car-miles or ton-miles, or in the quantities of coal in computing the averages so as to reflect a true average pound of coal per 1,000 gross ton-

miles and per passenger car-mile for road freight and passenger service, respectively. This committee also concurred in the recommendation of the Railway Fuel and Traveling Engineers' Association with respect to the amplification of Form OS-E to provide for equated pounds of fuel for all road passenger service per 1,000 gross ton-miles, including locomotive and tender, and in the suggested amplification of Forms OS-A and OS-E to provide for separate fuel performance results for Diesel locomotives in freight service. It recommended, however, that the changes in forms required to carry out these two proposals be deferred in view of the existing conditions until such time as the I.C.C. Bureau of Transport Economics and Statistics undertakes other substantial revisions of the OS forms.

In its report on the matter of fuel equivalents the Committee on Statistics of the Accounting Division referred to Note E on Form OS-E, which relates to the equating formula, as follows: "These instructions are understood to mean that the formula employed must recognize the existing facts and the values must be established in such a way that the service conditions, relative effectiveness of fuel, and local conditions peculiar to each railroad will be reflected in the equivalents used by that railroad.

"The consensus of your committee is that the fuel performance statistics to be of real value must reflect the facts peculiar to the types of fuel or power used and that fuel or power should be converted to a coal equivalent by the application of a true equation factor, which comprehends the relative effectiveness of the different types of fuel or power used as related to coal under similar service conditions on the reporting railroad.

"On behalf of the I.C.C. Bureau of Transport Economics and Statistics, Mr. Vallandingham, who was present during the discussion of the foregoing, agreed to insert an appropriate footnote to Schedule 571, Consumption of fuel by motive-power units, of Annual Report Form A, providing for showing the ratios used in converting other fuel to a ton of coal."

The report of the Railway Fuel and Traveling Engineers' Association committee concludes as follows: "With the support of the action here reported which has been taken by the highest statistical authority that the American Railroads have established, acting officially through regular organization channels, it is our hope that the comparatively small proportion of the companies that continue to equate their fuels and power to the coal equivalent value upon the unmodified basis of the relative thermal (B.t.u.) contents may be influenced to modify their views and practice to conform to the procedure that is being more generally followed.

The report was signed by E. E. Ramey (chairman), superintendent fuel conservation, B. & O.; P. E. Buettell, fuel supervisor, C. M. St. P. & P.; J. G. Crawford, fuel engineer, C. B. & Q.; J. R. Jackson, engineer tests, Mo. Pac.; H. Morris, superintendent fuel and locomotive performance, C. of N. J.; E. G. Sanders, fuel conservation engineer, A. T. & S. F.; W. R. Sugg, general supervisor air brakes, Mo. Pac.; W. J. Tapp, superintendent fuel conservation, D. & R. G. W.; and R. J. Tucker, assistant to fuel supervisor, C. & O.

Braking of Fast Freight Trains

Paper describes the new AB-1-B equipment which adapts the AB freight brake to the control of high-speed manifest trains up to 60 cars in length

By L. K. Sillcox

Senior Vice-President, The New York Air Brake Company



L. K. Sillcox

War conditions and modern competition are making it more than ever necessary that freight as well as passengers be moved at greater speeds. After careful study of the requirements for a satisfactory brake equipment for high-speed freight service, it was found desirable to develop such an equipment around the standard AB equipment as a basis.

The AB-1-B brake equipment is intended for use on freight cars equipped with high-speed trucks, such cars to be hauled in solid high-speed manifest trains up to 60 cars in length. Typical cars for this class of service would be of the refrigerator, specially assigned box cars, and container car types. Although cars having this equipment can be and are being used in passenger trains, I wish to emphasize that cars so equipped are primarily intended for use in freight trains. When used in passenger trains, AB-1-B equipped cars should be located at the head end of the train.

Cars equipped with the AB-1-B equipment can be used in standard freight service as well as in high-speed freight service. They have a signal line running throughout and air in this line is utilized to condition the equipment for high-speed service, while the absence of air in the signal line automatically conditions the equipment for use in standard freight service. The presence of signal-line air automatically adjusts the control valve to provide a direct build-up of brake cylinder pressure during an emergency application at a rate substantially the same as with passenger equipments. Operating in standard freight service where no signal line air is available, the control valve is automatically adjusted to provide the standard three-stage development of brake-cylinder pressure during emergency applications of the AB freight brake equipment.

The principal valve is known as the AB-1-B control valve and, in addition to the service and emergency portions common to the AB pipe bracket and emergency portion, a selector valve portion which is mounted on the filling piece, and a safety valve similar to that used with the D-22 control valves for passenger service. The safety valve is mounted on the selector valve portion and protects against brake cylinder pressure exceeding nominally 60 lb. during service applications. The signal line connections is made to the filling piece.

The service and emergency portions function the same as they do in the standard AB equipment, with the exception that the functioning of the selector valve portion has an influence upon the functioning of the emergency portion during emergency applications when used in high-speed freight service.

It has been previously mentioned that the safety valve is similar to the one used with the D-22 control valve. This is true as far as construction is concerned, but this statement must not be taken to mean that a safety valve from D-22 control valve can be used satisfactorily on the AB-1-B control valve. The range of the valve is different and safety valves intended for use on AB-1-B valves are marked on top of the hood with the letters "FRT" while those for D-22 control valves are marked "PASS" in a similar location.

Referring to the diagrammatic assembly of the AB-1-B control valve, Plate 1, it will be observed that the selector-valve portion consists of two diaphragm-actuated spring-loaded check valves *174* and *174a*. The selector valve portion is connected to the control valve proper by three passages *c10*, *c* and *b9*, and to the car signal line by passage *S*. Chamber *R* beneath the upper diaphragm is connected to brake pipe air by passage *b9* and check valve *174a* is forced from its seat by the deflection of the diaphragm as long as brake-pipe air, in excess of approximately 15 lb. per sq. in., is present in chamber *R*. Chamber *P* on the face of the lower diaphragm is subject to signal-line air when available and the diaphragm is, therefore, deflected to unseat check valve *174*. Check valve *174a* is located between passage *c* and the safety valve; check valve *174* interrupts passages *c10* and *c*.

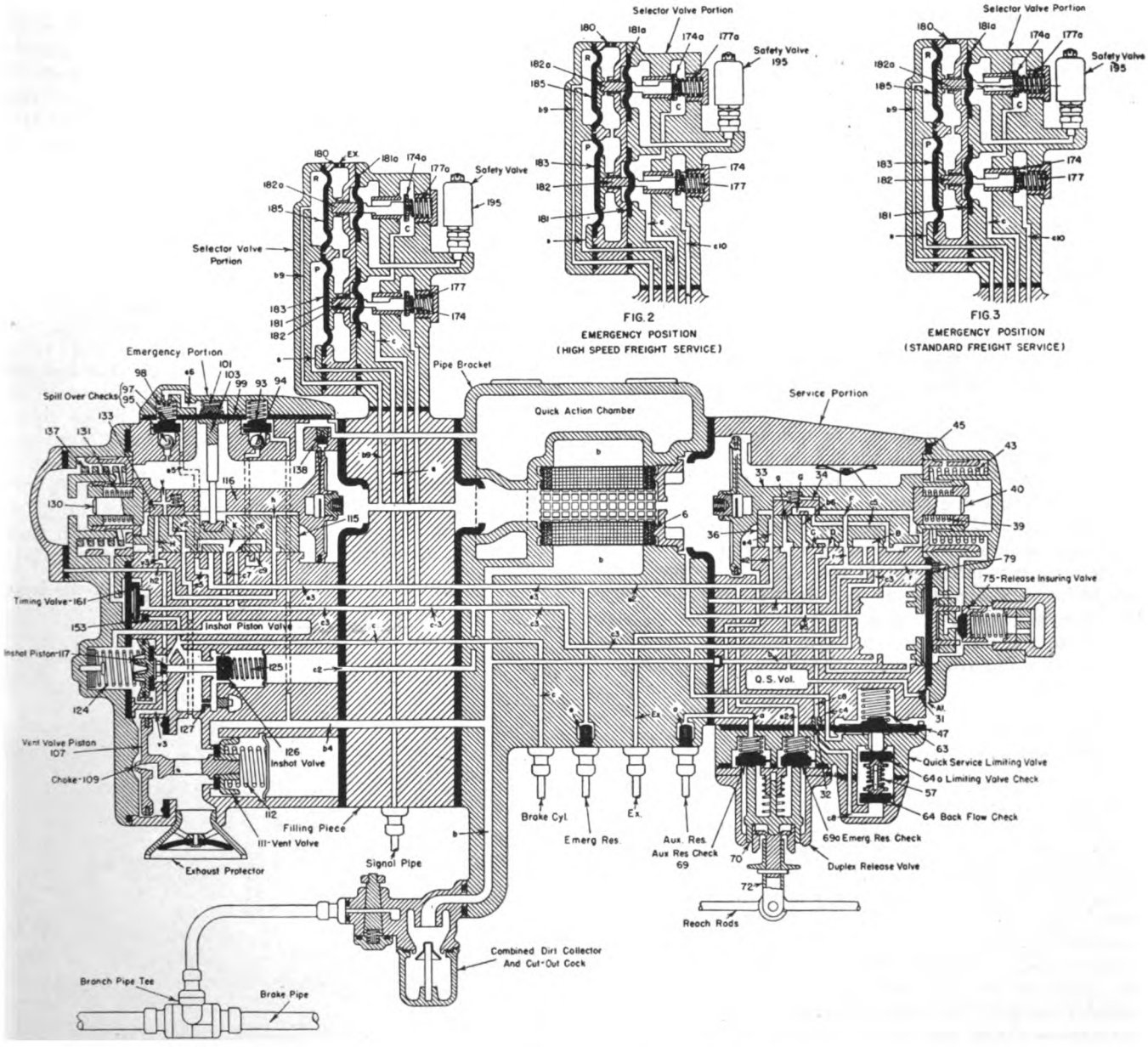
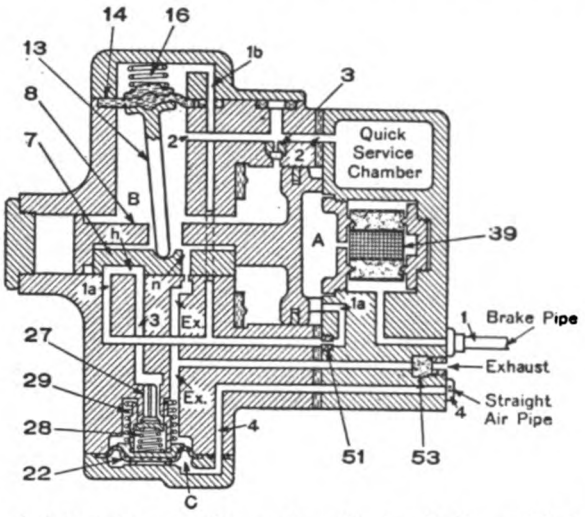


FIG. 2
EMERGENCY POSITION
(HIGH SPEED FREIGHT SERVICE)

FIG. 3
EMERGENCY POSITION
(STANDARD FREIGHT SERVICE)

AB-1-B valve for high-speed freight service (release position)

Operating in high-speed freight service and during a service brake application, the development of brake-cylinder pressure is the same as for the standard AB equipment, except that the safety valve is connected to



A-2-A continuous quick-service valve (application position)

the brake-cylinder passage by unseated check valve *174a* in the selector-valve portion; that is, auxiliary-reservoir air flows through the service portion slide valve to passages *c3* and *c2,* past unseated inshot valve *126* to passage *c* and brake cylinder.

Operating in high-speed freight service and during an emergency brake application, the development of brake-cylinder pressure is direct and not in three stages as is the case with emergency brake cylinder pressure development with the standard AB freight brake equipment. Combined emergency and auxiliary reservoir air in passage *c3* flows through passage *c10* and past unseated check valve *174* in the selector valve portion to passage *c* and the brake cylinder, thus by-passing the delay choke *127* and timing valve *161* which account for the second and third stages respectively for standard freight-service emergency brake-cylinder development. During emergency applications and because of the brake-pipe pressure being reduced to zero in chamber *R* of the selector-valve portion, check valve *174a* is forced to its seat by the tension of spring *177a,* thereby isolating the safety valve from the brake-cylinder passage *c.*

Because it is intended that these AB-1B equipped cars are to be associated together in high-speed freight trains, the use of an A-2-A continuous quick-service valve to speed up the time of obtaining a full service reduction throughout the train is recommended. This valve, although similar in construction to those used in high-speed passenger service, is differently calibrated. It is not vitally necessary inasmuch as the initial transmission of the brake application is accomplished very effectively by the normal quick service function of the AB-1-B control valve, but it materially increases the subsequent rate of brake application throughout all parts of the train.

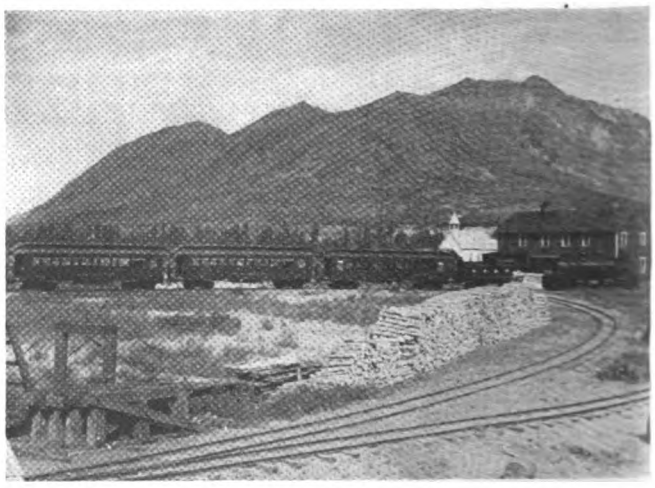
The A-2-A continuous quick-service valve is connected to the brake pipe as shown in Plate 2. Referring to the diagrammatic sketch of the valve, it will be observed that it consists of a quick-service chamber, a piston-operated slide valve, spring-loaded check valve and brake-pipe strainer. On one side of the piston is brake-pipe air while on the other side is quick-service-chamber air which is supplied through a charging choke during charging and releasing operations. The slide valve serves to connect brake-pipe volume and quick-service-chamber volume with the atmosphere during service applications.

During charging and releasing operations brake-pipe air flows through the strainer *39* to chamber *A* on the face of the piston from where it flows at a restricted rate through choke *3* to charge the slide-valve chamber and quick-service chamber. Owing to the restricted charging rate through choke *3* and the volume of the quick-service chamber, slide-valve chamber *B* will charge more slowly than chamber *A,* thus insuring that the piston will be held in release position during this operation. As the pressures on both sides of the piston become balanced the piston will remain in release of its own inertia.

When a service rate of reduction is initiated at the brake valve, a reduction of pressure takes place in chamber *A* and the piston and slide valve after an approximate differential of one-half pound is obtained, moves to application position as shown in the diagrammatic sketch. The slide valve then connects brake-pipe air in chamber *A* with the atmosphere by way of passage *1a,* choke *51,* passage *3* and unseated check valve *27.* Quick-service-chamber air is also connected to atmosphere by the safety valve through port *n* and port *EX.* Choke *51* and the exhaust port in the slide-valve seat are calibrated to permit the quick-service-chamber pressure to reduce faster than brake-pipe pressure and as soon as the former reduces to one-half pound less than the latter, the piston will automatically reassume release position. As the brake-pipe reduction continues, the continuous quick-service valve repeats this movement each time reducing the brake-pipe pressure a small amount and thus continuously propagating the brake-pipe reduction from car to car. For split or successive brake-pipe reductions, the continuous quick-service valve operates during each reduction to perform the quick-service function as described. It, therefore, appreciably reduces the time required to obtain service brake application throughout a train.

The AB-1-B freight-car brake equipment, in addition to the devices already described, includes the double compartment reservoir, brake cylinder, retaining valve, brake-pipe cutout cocks, combined dirt collector and cutout cock, branch pipe tee, hoses and couplings which are common to the standard AB freight-car brake equipment. Also included is a standard signal line consisting of cutout cocks, hoses and couplings. A number of AB-1-B equipped cars which are at the present time being built for service in troop trains to relieve the standard Pullman car shortage are also equipped with slack adjusters, although fundamental schedules do not make them mandatory.

* * *



On the White Pass & Yukon

Coal Sizes in Relation to Fuel Economy



S. A. Dickson,
Chairman

How the specific gravity of impurities from coal is used to control the ash content

In attempting to reach that ideal state of perfection in locomotive fuel distribution, an ideal size for every need would undoubtedly bring the highest efficiency, but non-ideal conditions have a way of injecting themselves into the picture with rather inefficient results. As the negro boy who went fishing and came back with nothing but poison ivy remarked, "it ain't what you'all wants, but what you'all gits that counts."

In approaching the problems of the best size for the best results, we should, divide the procurement of coal into three fields:

1—The carrier which owns its own mines and controls the entire output thereof.

2—The carrier that purchases its coal from a definite source with little, if any, fluctuation in the commodity and where such mines are located on its own line.

3—The carrier that is compelled to purchase its supplies on the open market, off line and from any source where supplies may be available.

The problem of the carrier in category No. 1 is quite simple. Assuming the mines to be equipped with a fair degree of modern equipment, the coarser sizes may be screened out and used for stations in the ordinary stoves and heaters. Egg sizes may be utilized for smaller hand-fired power, small locomotive-type power plants and yard locomotives. The smaller sizes, provided they can be cleaned, especially where mechanical cleaning plants are available, would then make an ideal stoker fuel for the stoker-fired locomotives as well as large power plants.

The problem of the carrier in category No. 2 is decidedly more complicated. In such set-ups the commercial demand on the mines may run as high as 50 or 60 per cent of the output and with its seasonal changes the railroad necessarily becomes the buffer between the mines and the commercial consumption.

It is generally conceded that a locomotive can be equipped with the necessary grates to burn economically and efficiently, let us say, 1¼ in. x 0 screenings, but with a constantly changing picture of available fuel, it is obvious that the locomotive must be drafted and grates provided that will burn all different sizes of coal under almost any conditions.

Coaling stations could, of course, be equipped with crushers to reduce all coal to say 2-in. maximum size, but it is doubtful whether there would be any economy in such procedure unless all the locomotives served by such a shed were of a modern type with comparatively large fireboxes. Certainly, it would not be economical to crush egg or lump coal to screening size and then utilize such coal on a heavy Mikado locomotive with 26-in. or 27-in. cylinders and a firebox of probably 50 or less sq. ft. of grate surface. In this connection it might be well to consider the size of the fuel in direct relationship with its characteristics.

Screenings of a rather high B. t. u. content, with a comparatively low ash and sulphur content with a high ash fusion could undoubtedly be used in almost any kind of a stoker—or even hand-fired locomotive, provided the coal could be raked. But should we attempt to place screenings of a B. t. u. content of say 10,000 with an ash fusion of 1800 deg. to 1900 deg. on the same type of locomotive, conditions would become intolerable due to the heavy clinker formations and consequent delays.

The texture of the coal which governs the chemical break-down in the firebox, as well as the breakage in transit and in handling, must be given consideration when the best size for the highest efficiency is considered. A good test tube analysis is not always a good criterion of what will take place in the firebox. Some coal that might analyze rather high in fixed carbon and volatile matter will fail as a good locomotive fuel due to its rapid chemical break-down, in that most of the volatile gases escape unconsumed because of incomplete combustion due probably to the locomotive being drafted for a different kind of coal.

Under the above mentioned conditions it appears that the greatest efficiency can be obtained by making a study of all the fuels offered and taken for consumption and distributing this fuel to the various districts to the best advantage. Such a plan requires constantly changing distribution as it obviously is not possible or even contemplated to change the locomotive characteristics for every change of fuel. This makes it extremely important that type and size of fuel offered be under continuous surveillance.

With the rapid advance of stoker equipped locomotives superseding the hand fire power, the problem of obtaining coal in smaller dimensions becomes more and more acute and present conditions do not help maintain the best possible distribution. Shortage of desirable fuel and sizes coupled to car shortages and fuel storage programs, all make it extremely necessary to make every move in distribution count to the N'th degree.

Coal Washing

Considerable misconception still exists among railway operating and purchasing men as to the meaning of the term "Mechanically cleaned coal." Many visualize mechanical cleaning, which consists chiefly of pneumatic and wet washing processes, as surface rinsing with water applied through sprays when this is definitely not the case.

The washing process is based on a relationship existing between the percentage of impurities in any piece of coal and its specific gravity. The exact relationship existing between the specific gravity and the impurity content of the various fractions of any sized coal is

determined through a washability study of the sized coal involved. In such a study, use is made of several vats containing zinc chloride solutions ranging from 1.60 specific gravity through 1.55, 1.50, 1.45, to 1.40. In selecting cases the gravity range may be broadened or the separation bands reduced to 0.25 specific gravity.

A representative sample of the coal under investigation is first passed through the 1.60 specific gravity solution vat where the heavier impurities such as pyrites and rock will sink. The portion of the sample floating in the 1.60 specific gravity solution is then transferred to the 1.55 specific gravity solution vat where additional impurities and middlings (heavy impurities adhering to coal) will sink. This operation is continued through the various graded specific gravity solution vats until the entire sample has been broken down into the fractions that will sink or float at the different specific gravities used in the study.

After this float and sink study has been completed, the various fractions are reduced, weighed and analyzed. From the resultant data, the loss, the recovery, and the finished product ash content at any specific gravity or point of separation can easily be calculated.

The accompanying table gives the results obtained in the breakdown of a mid-western raw coal that was a poor locomotive fuel when used in its raw state. This data only covers the screened 4 in. x 0 size which is used for locomotive steam generating purposes after having been mechanically cleaned.

During the washing process it is customary to remove all substance smaller than 28 mesh (approximately one-half millimeter) at this mechanical cleaning plant. The finished coal product is 4-in. x 28 mesh. At other mining properties all of the 1¼-in. x 0 screenings are removed making a 4-in. x 1¼-in. sized product.

Effect on Ash Content of Removing High-Gravity Impurities from Coal

	Coal, after eliminating 28-mesh fines (20.55 per cent ash) = 4-in. by 28-mesh, 12.93 per cent ash Per cent				Coal, after eliminating 1¼-in. by 0 screenings (14.8 per cent ash) = 4-in. by 1¼-in., 12.33 per cent ash Per cent			
Separated at	Sink	Ash	Float	Ash	Sink	Ash	Float	Ash
1.60 spec. gr.	4.82	57.95	95.15	10.64	2.75	52.94	97.25	11.08
1.55 spec. gr.	5.84	53.30	94.16	10.43	3.87	46.19	96.13	10.87
1.50 spec. gr.	6.79	49.45	93.21	10.27	4.22	44.51	95.78	10.81
1.45 spec. gr.	8.31	44.69	91.69	10.05	6.16	38.10	93.84	10.54
1.40 spec. gr.	11.17	35.18	88.83	9.76	8.76	32.41	91.24	10.30

Base material: raw 4 in. x 0 coal, 13.68 per cent ash.

It will be noted the ash content of the raw coal 4 in. x 0 (13.68 per cent) is drastically reduced by removing the 28 mesh x 0 in. size of the 1¼ in. x 0 screenings. After this improvement in quality the ash content is further reduced as the specific gravity point descends on the specific gravity scale until at 1.40 specific gravity, the ash content of the 4 in. x 28 mesh floatings is only 9.76 per cent and the 4 x 1¼ in. floatings is only 10.30 per cent.

The variation in ash in the two finished sizes is due to more free impurities that can be removed from the smaller sizes of coal.

It is apparent from the table that a product ranging in ash content from 13.68 per cent to 9.76 per cent can be produced at will by selecting the proper size and the appropriate specific gravity control or separation point. The ultimate point of ash reduction depends upon the inherent ash content of the coal and the specific gravity at which separation ceases to be practical from an economic standpoint. This is the significant factor in mechanical coal cleaning operations: a uniform low-ash product.

Assuming that the coal covered by the table is mechanically cleaned to a 1.45 specific gravity adjustment control. Each piece of substance entering the cleaner is automatically checked against this specific gravity. All substance having a specific gravity heavier than 1.45 will sink, while those of 1.45 specific gravity or lighter will float.

The sinkings are removed, crushed, and rewashed for screenings. The floatings are passed out of the cleaner and, if it is of the wet washing type, will be rinsed with clean water, dewatered on a special screen, and loaded in railway cars for shipment.

At large mining establishments samplers and chemists continually check the quality and uniformity of their product by frequently analyzing samples throughout each day's run. Railway inspectors should watch closely the work of these men and in addition have samples taken and analyzed under their own direct supervision.

While under existing conditions the cost of mechanically cleaned and raw locomotive coal is the same, the results obtained are not.

It can be seen from the data given that mechanically cleaned coal gives the mine operator a positive control over the ash content of his product and assures the consumer a uniform quality low ash coal. To the consumer low ash means increased B. t. u.'s per pound. Railways using raw coal in fields where mechanically cleaned coal is available should carefully investigate the improved locomotive performance and reduced fuel bills that result from the adoption of mechanically cleaned coal.

Owing to the changed conditions brought on by the war the fuel picture for our railroads have also changed. Therefore we must adjust ourselves to meet these conditions before they arrive whenever possible, through foresight and planned schedule. To show one of the many changes that have occurred on our American railroads we quote the fuel picture change of one railroad.

Last year at this time about 66 to 70 per cent of the total coal used was slack coal 1⅝ in. x 0, 1½ in. x 0 and 1¼ in. x 0, depending on the territory from which it was received. This year on account of the emergency the mines will not sell the slack in the same proportions as they did a year ago, and the percentage to the total now used is 35 per cent. Despite this they are using a greater amount of the larger coal, costing more money. For example, in April their fuel cost increased $90,749.00, due to the following:

1—Increase in price	$41,000.00
2—Increase in consumption	11,187.00
3—Due to use of higher per cent larger sized coal	38,562.00
4—Loss of bony	550.00
Total	$90,749.00

In April, 1942, 66 per cent of the total coal used was slack, in 1943, 34 per cent. Naturally, as they purchased a larger size, according to the testimony that they received at their various meetings, they would use less of it than of the slack coal. But, unfortunately, this was not the case.

Of course delays to trains at terminals and enroute, which is reflected in a lower average speed this year was responsible for some of this loss. New men, also, were a contributing factor. How much value should be placed on each of these two items as cause for increased coal, consumption is, of course, hard to calculate.

The report was signed by S. A. Dickson (chairman), supervisor fuel economy, Alton; M. B. Adamson, fuel inspector, C. R. I. & P.; P. E. Buettell, chief fuel supervisor, C. M. St. P. & P.; W. J. Tapp, superintendent fuel conservation, D. & R. G. W.; and S. R. Tilbury, fuel supervisor, A. T. & S. F.

Master Boiler Makers Again "Meet" in Print

Reports on staybolts and flues are presented in this issue—Suggestions for improvements in locomotive firebox design



Myron C. France, President



A. F. Stiglmeier, Secretary-Treasurer

FOR the second successive year the Master Boiler Makers' Association has been forced, because of the war-time pressure, to forego holding a regular convention. They have chosen, however, to continue the work of their committees and to publish their "proceedings." In 1942, this plan worked out successfully as a substitute measure and the papers submitted by the committees received favorable attention from the entire membership.

Five subjects were chosen for investigation and the preparation of reports in 1943. Of these, only two have been completed to the point where they can be published in this issue. Others will be published in later issues of the *Railway Mechanical Engineer*. All will be available later in the bound volume of the Association's proceedings. In addition to the work of individual committee members the reports are based on summaries of the replies received from the chief mechanical officers of the Class I railroads of the United States and Canada to questionnaires sent out by the Association with the approval of the Mechanical Division of the A. A. R.

Topics No. 1 and No. 4 are covered in this issue: Topic No. 1 is on application of staybolts and service obtained from various types and materials; Topic No. 4 is on the subject of application, maintenance and blowing of flues and tubes. Two papers on each are presented here, one of which is the main report of the committee and the other a contribution of one of its members. The subject of Topic 2 is autogenous welding and cutting in the boiler department; Topic 3 deals with blowing down, washing and filling boilers, and Topic 5 with cinder cutting of flues and tubes, its causes and prevention. The responses received to the questionnaires represented a high percentage of those sent out.

The officers who served during 1943 will continue in office for the year 1944. They are: President, Myron C. France, general boiler foreman, C. St. P., M. & O., St. Paul, Minn.; vice-president, Frank A. Longo, general boiler inspection, So. Pac., Red Wood City, Calif.; secretary-treasurer, A. F. Stiglmeier, general supervisor boilers and welding, N. Y. C., New York. Members of the Executive Board will also continue to serve. There has been one change on the Advisory Board, E. L. Grimm, general mechanical superintendent, Northern Pacific, St. Paul, Minn., having replaced D. S. Ellis, who is now vice-president in charge of manufacture of the Lima Locomotive Works, Inc.

Staybolt Practice and Performance

Progress continues in study of methods and materials—Higher boiler pressures present problems—Boiler design and staybolt spacing important

[The report contained a summary of the answers received from fifty railroads to a set of 36 questions concerning staybolt practice and staybolt performance. The essential information is contained in the committee's discussion of the questionnaire.—EDITOR.]

Analyzing the questionnaire we find that iron staybolts are still the old stand-by, although there is something taking place in our high-pressure fireboxes that is hard to overcome with iron. When iron staybolts are being driven they leave a picture as shown in Fig. 1.

Questions on service life indicate, at present, that there is no trouble experienced with iron staybolts in regard to breakage or leakage. The reason for this improvement may involve all of the questions asked or it may be only one or two. We are unable to state which one has been the contributing factor. From our own experience, on certain classes of locomotives, and considering the division or territory on which they are operating, we are still undetermined as to the cause of leaky staybolts. We have not found a method, as yet, that will cure it. Some improvements have been made and several new methods have been tried which will be mentioned. General boiler shop practices when applying staybolts, including all operations to a finished staybolt, indicate that we are all making a real effort to have staybolts applied by the best method possible. We believe that there is still room for improvement. On our visits to engine terminals we find that complaints on fit and other details are very much in evidence. Shop forces are held to be at fault. Methods of tightening leaky staybolts are numerous and each one gives very good results. During all the years this Association has had this topic in one form or another, the discussion has been one of the best, but the solution to the problem has never been found. However, according to answers received to the questionnaire, we have no more trouble with staybolts, no breakage and no leakage. The locomotives involved are both freight and passenger. The Master Boiler Makers' have been favorably impressed with chemically treated boiler water and the consensus of opinion is that with a well regulated water treatment boiler and firebox conditions have improved.

It is also the consensus of opinion that if you treat boiler water, a manual or continuous blow-down must be used to get the benefit from treated water. Opinions as to the cause of leaky staybolts are varied although we are of the opinion that seven causes are contributing factors.

Seven Causes of Staybolts Leaking

Mechanically we are partly to blame because staybolts have never been taken seriously because of the easy manner in which they can be made tight. Today, the staybolt is a big factor and proper application must be taken seriously. Overheating is a factor very much in evidence on every locomotive which is stoker fired and, with the great demand for speed and tonnage, it cannot be overcome when extra efforts are needed for steam.

Every locomotive equipped with a feedwater heater will be more or less in trouble, although the feedwater heater is a device for saving water and steam by the use of a condensate pipe into the tender tank. Filters, skimmers and other devices have been tried with very little success for removing the oil from the water returned to the tank through the condensate pipe. Mulsified oil then finds its way back to the boiler. The oil is one of the greatest factors to be overcome.

Some roads are fortunate in that they pick up water on the right-of-way. This will overflow the skimmer or filter when the tank is filled. Others that depend on terminal forces and way-side filling stations are not so fortunate. The tank is never filled to overflowing and the skimmer or filter does not remove the oil. It has been proved by many railroads that releasing the condensate to the atmosphere saves staybolts and side sheets. This may be a fact but there are still some boilers running with heaters operating and condensate water returned to the tanks that also have tight stavbolts.

Therefore, the subject of oil is still to be discussed although there is no question that, if oil was eliminated entirely, boiler and firebox parts would be free from leaks and cracks.

We all know what scale will do to our staybolts and side sheets. We believe that a proper and well balanced water treatment or, better still, the use of nickel-clad firebox steel which will remain sufficiently free from scale, gives a cooling effect to the sheets because the water remains in contact with the sheet. Some installations of nickel-clad steel have given increased service life.

Every one of us would like to have the smallest bolt possible because of many factors which will help towards staybolt service life. Opinion seems to favor a staybolt not any larger than 1⅛ in. at fire side. Anything larger than that may increase leakage.

The committee believes that the spacing of staybolts in our high-pressure boilers must be changed. The distortion, or corrugation as you may call it, will pull the head of the staybolts. This is due to strain on the area supported. When this distortion takes place, the staybolt fit in the sheet has been destroyed, as shown in Fig. 2, and hammering or caulking will not make it tight.

If spacing of staybolts is changed there will be no need of a sheet heavier than ⅜ in. in any high-pressure boiler.

Engine-Terminal Procedure

We would recommend that the Master Boiler Makers' Association go on record for the approval of the following procedures which must be adhered to:

When Crew Leaves the Engine—The engine crew will have full fire over the entire grate area, a full head of steam, and at least three gauges of water in the boiler.

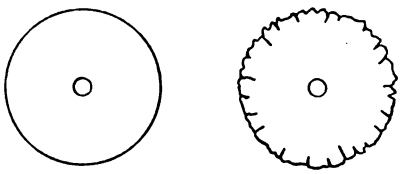


Fig. 1—General appearance of steel and iron staybolts after driving

At Ash Pit—Before starting to clean the fire, check for full head of steam and at least three gauges of water, then open ash pan slides and clean the fire. Use the blower just enough to clear the firebox. After the fire is cleaned, build a fairly good fire over the entire grate area, and bank the edges along the sheets to prevent air from entering the firebox. Fire should be maintained in this condition until the engine is ready for road service when the fire tender should level the fire. If, for any reason, it is found necessary to remove the fire, the following precautions should be taken. Ashpan slides and the fire door should be closed. In cold weather the cab curtains should be drawn. The engine should be moved into the house as quickly as possible.

Blowing Down—Reduce the pressure in the boiler about 25 lb., allowing approximately 15 min. for the temperature to equalize. Repeat this process until the pressure is reduced to about 50 lb. After 30 min. blow the remaining steam pressure and drain the water from the boiler. If the boiler is to be washed out, its temperature should be nearly the same as temperature of the water used to wash the boiler. If it is not the boiler should be allowed to cool until the two are at the same temperature.

Filling—After the boiler work is completed the boiler should be filled with water of the same temperature as the boiler plates and a bed of coal about 3 in. deep placed over the grate area.

Firing Up—Fires shall be raised as follows: 1 hr., 50 lb.; 2 hr., 150 lb.; and 2 hr. 30 min., full pressure. The fire tender should maintain the fire as set up in the procedure until the engine is called for.

Choosing and Applying Staybolts

Fifty Santa Fe locomotives came to one road with a full installation of flexible staybolts and for a period of 12 years the flexible staybolts in the lower portion of

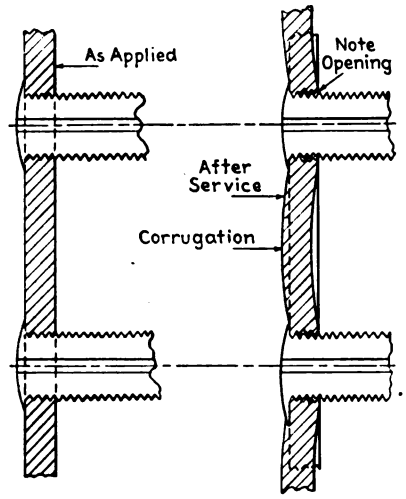


Fig. 2—When distortion occurs staybolt fit in the sheet is destroyed

the firebox required frequent renewals and new side sheets were often applied. Since an outer wrapper sheet was removed and drilled for rigid hollow staybolts service life of the staybolts has been indefinite. It became necessary to remove these sheets after eight years when cracks developed on the water side of the firebox. When holes in the outer wrapper sheet become large, the staybolt shown in Fig. 3 may be used. This method will gain favor because of its simplicity. The staybolt may be of any size, depending on the road's condemning limit. When a staybolt of this type is to be used it should be chased down to thread size and be at least 1 in. longer than the water space in the boiler. Thread the large end, then the small end, allowing the small threading die to come in contact with the large end of the staybolt. This gives a tapered section between the two thread sizes.

The following procedure gives good results in tapping out the boiler for this type of a staybolt. Use any good tap of the right size and break off the reaming part leaving just enough on the remaining piece to give a full size thread in the hole without interfering with the firebox sheet. Weld a pilot on the end of the tap for guidance. Tap the firebox side first with the small tap. Run the large tap through the wrapper sheet far enough to give a full thread. Apply the staybolt, making sure that the small end of the staybolt will enter the firebox sheet first. If all of the staybolts are of the same dimension at the large threaded end there will be sufficient thread on the outside. Cut the staybolts off at both ends. The use of a hollow rigid staybolt will eliminate the necessity of drilling a telltale hole. Application of molybdenum iron staybolts did not show any improvement over the ordinary iron staybolt in regard to heat

Load on Staybolts of Various Sizes at Different Pitches 7,500 Lb. I. C. C. Calculated for 265 Lb. Boiler Pressure—Telltale Hole Used

Bolt size in.	Diameter at root, in.	Area at root, sq. in.	Pitch on sheet, in.	Boiler pressure, lb.	Load on bolt, per sq. in.
7/8	.7668	.4617	3.5 x 3.5	265	7476
7/8	.7668	.4617	3.75 x 3.75	265	8582*
7/8	.7668	.4617	4 x 4	265	9797*
15/16	.8293	.5401	3.5 x 3.5	265	6333
15/16	.8293	.5401	3.75 x 3.75	265	7260
15/16	.8293	.5401	4 x 4	265	8271*
1	.8918	.6246	3.5 x 3.5	265	5436
1	.8918	.6246	3.75 x 3.75	265	6242
1	.8918	.6246	4 x 4	265	7123
1 1/16	.8918	.6246	3.5 x 3.5	265	4720
1 1/16	.8918	.6246	3.75 x 3.75	265	5419
1 1/16	.8918	.6246	4 x 4	265	6165
1 1/8	1.0168	.812	3.5 x 3.5	265	4137
1 1/8	1.0168	.812	3.75 x 3.75	265	4750
1 1/8	1.0168	.812	4 x 4	265	5400

*Not to be used.

in high-pressure boilers although we have been of the opinion that a higher heat-resisting material would improve the condition. The use of Monel staybolts indicated that there are some shop practices which, in all cases, are detrimental to any material whether iron or steel.

Three locomotives of the same type and class, operating in pool service over the same territory, have given varying performances. Two of them failed because of staybolt leakage and cracked sheets within a short time; the remaining locomotive is still in service and the staybolts and sheets are in excellent condition with a very good mileage. All the staybolts were purchased threaded within tolerances allowed. All the taps were within tolerances allowed, but being of a small size, 7/8 in., and not a stock size, only six taps were purchased. On the boiler which had the first application, using the new

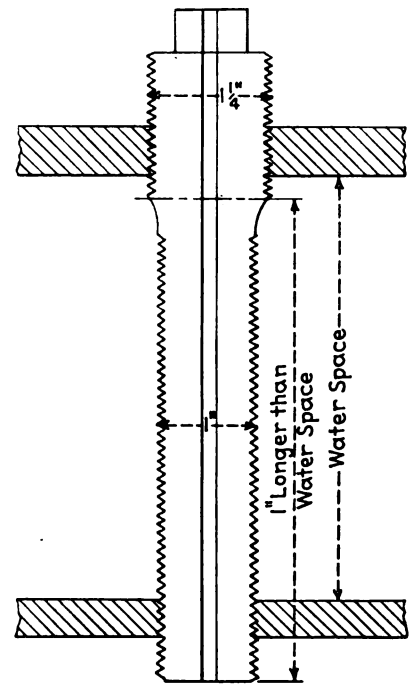


Fig. 3—Staybolt to be used when holes in outer wrapper sheet become enlarged

taps, all the staybolts were applied with a tight fit. Close supervision was given to the application, and this boiler still remains in service and has given no trouble. After all the holes had been tapped on the remaining two boilers, using the same taps, it was found that the purchased staybolts were a little too tight and they had to be recut by the railroad. These applications were not

given any special supervision although regular shop practices were followed. The results were as given.

Electric and Diesel-electric locomotives have passed through the experimental stage and may now be considered as permanent additions to the railroads. With the cooperation of boiler designers, builders and the master boiler makers, we should be able to obtain longer service life from staybolts. The only substantial claims made against the value of the steam locomotive are availability and the high cost of maintenance. Staybolts in one form or another are one of the big problems. Let us give this serious thought, not as individuals but as a craft, in order to overcome this problem.

Welding Staybolts

One road was using iron staybolts and the heads of these bolts would fray, as shown in Fig. 1, while being hammered up. It did not appear that a good seal weld could be made. A test application was made in April, 1943, on a locomotive boiler operating in a territory on which trouble was being experienced in keeping staybolts tight. Leakage sometimes started within three months and sheets had to be renewed within twelve months. The test was made on standard railroad deoxi-

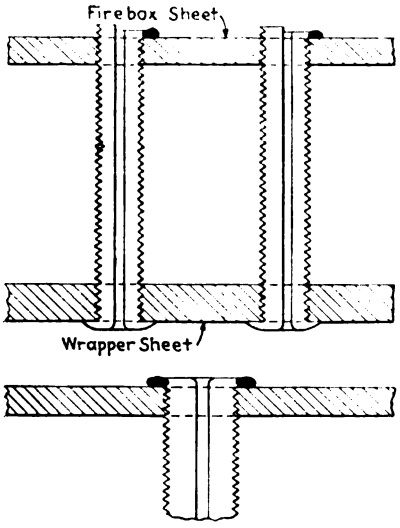


Fig. 4—Edges should not be rolled down when staybolts are to be welded

dized firebox steel with 1-in. dia. iron staybolts on one side of the firebox. A nickel-clad deoxidized firebox steel plate with ⅞-in. Monel steel staybolts was applied to the other side. After being driven, all the staybolts were seal welded as shown on the sketch. The locomotive has made 32,200 miles since application, and both sheets and staybolts are in excellent condition. We wish to submit to the Master Boiler Makers' Association, and if necessary to carry to a conclusion, to the Association of American Railroads, a proposal that six leading railroads, which are now experiencing trouble with staybolt leakage, be permitted, on a new firebox or side sheet renewal to apply hollow rigid or hollow flexible staybolt (hollow rigid preferred) seal welded to the sheet nine rows high from the mud ring.

After the holes are drilled, the surface of the sheets are to be cleaned around the staybolt holes, using the best method available. Sandblasting or grinding are preferable. A soluble oil should be used in tapping the holes. Staybolts should be applied in the usual manner. The staybolts should project three threads out of the sheet for heading over. The staybolts in the outside sheet should be driven first and the staybolts on the inside sheet driven with a flat die. Edges should not be rolled down. When the sheet is clean seal weld the staybolt heads to the sheet with a small bead in one pass if possible, using the best covered electrode available.

Once the staybolts have been seal welded, no further welding is to be applied at any time. If the staybolts develop leaks they should be renewed, cleaned and welded. Reports should be furnished to the Association annually, or more often if necessary.

Well-Formed Staybolts and Accurate Sheet Layout Essential

[In addition to the main report of the committee and the paper by Mr. Huston a short paper dealing with the manufacture of staybolts and the proper layout of firebox sheets as factors in securing good staybolt performance was prepared by Leonard C. Ruber, superintendent locomotive department, Baldwin Locomotive Works, who is a member of the committee. The following is taken from Mr. Ruber's paper.—EDITOR.]

In the fabricating of the staybolts the material used should be sufficiently large in diameter to permit a full thread when the bolts are completed. In threading of staybolts it is important to have machines which preferably have center lead screws, so the pitch of the threads of bolts when completed will be cut to a tolerance of .0015 plus or minus per 1 in. Where possible in order to check the bolts properly for form of threads and pitch of threads a Comparator type of machine should be used; this will always prove valuable in getting first-class threading operation. Threaded bolts should be checked periodically as an assurance against possible changes in the position of chasers in the threading machines, and possible lost motion in wearable parts of the threading machine. In addition to the method of checking with a comparator the operator should be provided with simple gauges so that he can make continual check on threaded bolts.

In all cases a master gauge should be provided to check the gauges used in checking the staybolts.

It is advisable to use hardened-steel ground chasers for the threading operation which give additional assurance of good threads.

In threading the crown stays and all other stays where the ends are upset to larger diameter it is most important that all forgings are made straight and that the upset ends of the bolts are parallel with the axis of the bolts.

After securing a first-class job of fabricating staybolts it is most important that every possible provision be made and every care be taken to have all staybolts applied to boilers so the bolts will give to the purchaser a long life of service.

In applying the staybolts to boilers it is most important the plates be laid out carefully so the line-up will be just as it was intended when the boiler was designed. In order to secure this condition a great amount of attention must be given to the drilling of holes for staybolts and sizes of drilled holes must be sufficiently small to allow the holes to be reamed to the proper diameter for tapping, thus insuring a first-class fit of the staybolts in the holes.

It has always been considered a very good job of staybolting if when bolts are applied they can be turned without much force, but there must not be any possibility for anyone to shake the bolt in the hole. In many cases some men are disposed to consider the bolt loose in hole if it is possible to move the bolt with a small amount of exertion, but the laws of mechanics teach us otherwise, and therefore we have always considered a

aybolt application first-class if applied as outlined above.
In applying the flexible staybolt to boiler it is conlered by most boilermakers, and rightly so, the best ethod of application is to screw the bolt into the sheets itil bolt is properly seated in sleeves. Applying bolts this manner it is a generally accepted fact greater surance is given that each hole is carrying the oper load.
In hammering over the ends of bolts most boilermakers el if the bolts are properly applied and not loose in ole it is important that a hammer which does not give o heavy a blow be used. The hammer should be only of a capacity sufficient to properly head over the bolts.

The report was signed by Sigurd E. Christopherson (chairman), supervisor boiler inspection and maintenance, N. Y., N. H. & H.; Leonard C. Ruber (vice-chairman), superintendent boiler department, Baldwin Locomotive Works; C. H. Pollock, boiler foreman, American Locomotive Company; C. G. Mullenhour, superintendent of boiler department, Lima Locomotive Works; S. S. McConnell, general boiler foreman, Erie; C. A. Marinan, mechanical inspector, M. St. P. & S. S. M.; E. J. Brennan, general boiler foreman, B. &. M., and F. P. Huston, The International Nickel Company.

A Study of Firebox Materials and Design

Reduced staybolt diameter and closer spacing recommended to lower stresses both in sheets and bolts

By F. P. Huston,
The International Nickel Company, Inc.

THE following classification of firebox failures pertains primarily to side sheets because the conditions that bring about failure are generally aggravated at the side sheets and hence failures are apt to occur at this location earlier than in other locations. However, essentially the same forces are at work in all locations and failures of more or less the same nature may occur in any portion of the firebox.

Cracked Sheets

Cracks which occur on the fire side only and designated as "fire cracks" invariably start at the edge of the staybolt hole and usually extend in a vertical direction. The cracks may, however, extend horizontally rather than vertically and in some cases in all directions to produce a condition designated as "star cracks".

The immediate cause of the cracking of the side sheets may be attributed properly to leaky staybolts. There is no record of an instance of sheets cracked on the fire side in the absence of leaky staybolts. The ultimate cause of the cracking is the combined action of localized bending stresses in the sheet material due to thermal stresses and the corrosive action of the boiler water leakage concentrated by evaporation from the hot metal surface. This condition is often designated as "stress corrosion".

Cracks on the water side only, in appearance, location, and extent, are usually almost identical with the cracks on the fire side. The mechanism which produces the cracks on the water side must be different from that at work on the fire side since there is no apparent opportunity for the concentration of the boiler water by the simple action of evaporation from a hot metal surface. However, there is an opportunity for concentration to occur under a layer of porous scale. Such concentrated alkali in conjunction with the localized bending stresses on the water side may bring about failure through the same type of stress corrosion as that occurring on the fire side.

Cracks on both the fire side and the water side are obviously caused by a combination of both conditions just described.

Figs. 1 and 2 show different surfaces of a specimen taken from the central portion of a side sheet and illustrate fire-side cracking, water-side cracking, and excessive corrugations. The side sheets represented by this specimen required renewal after only 47,594 miles in the period from May, 1942, to March, 1943.

The remedy for the condition where cracks occur on the fire side only is found obviously in maintaining the staybolts free from leakage and for cracks occurring on the water side only in maintaining the water-side surface free from scale either through the use of adequate water treatment, of a material that is not subject to this type of cracking or of a material to which scale will not adhere.

Excessive Staybolt Leakage

This condition is the result of partially stripped threads due usually to faulty design of the staybolted assembly and the related boiler structure aggravated by the damage done to the threaded joint when corrugating of the sheet occurs as a result of overheating. The leakage ultimately leads to the failure of the sheets from corrosion cracking. The cure for excessive leakage in the case of joints improperly designed is a change in design which will provide an assembly better fitted to carry the load imposed upon it. This may involve a change in the staybolt material, particularly the elimination of the use of soft puddled iron bolts in favor of a material of better mechanical and corrosion resisting properties. A steel of higher tensile strength may be required in the firebox sheet to provide adequate strength in the threads. The seal welding of the bolts may be advisable or a better means of fitting the bolts in the sheets may be necessary. Where failure occurs due to overheating it is necessary to provide against the formation of scale on the water side.

Corrugated Sheets

Buckling of the firebox sheets within certain areas is a normal and a necessary action in order that the sheets may absorb the movements set up by thermal expansion and contraction both in the sheets themselves and in the tubes. However, when, due in many cases to improper firing or improper handling during turn arounds and boiler washes, the stresses become so large that permanent deformation takes place and the condition

known as corrugation occurs premature failure results.

Sometimes a newly designed firebox will corrugate and fail after a relatively short period of service due to unforeseen localizations of stress. In most cases the sheets are able to adjust themselves so that service life comparable to that of the older box is obtained after the first repair, though sometimes failures persist due to inherent faults of design.

The most important cause of corrugating is overheating due to water scale which insulates the metal against the cooling action of the water. The metal in this case may reach temperatures of 1,000 and 1,200 deg. F. Fig. 3 shows diagrammatically the increase in fire-side temperature to 1,010 deg. F. due to a scale layer only .050 in. thick while a scale-free surface under otherwise identical conditions results in a safe operating temperature of 560 deg. F.

Thermal stresses of high order imposed upon metal weakened by the high temperature result in severe permanent deformation. Even before the deformation reaches a point where excessive corrugations are observed an indication of its occurrence is given by the leakage of staybolts, especially when the firebox is cooled down for boiler washing.

The effect of corrugation on tightness of staybolts screwed through with ends riveted over may be shown by applying a pressure to a staybolted test assembly sufficiently high to deform the sheet permanently between the staybolts. Fig. 4 shows such a test assembly where seven 1-in. dia. iron staybolts were applied in a 16-in. dia. closed vessel. The staybolts were free from leakage up to and including 1,500 lb. per sq. in., pressure but leaked freely on reducing the pressure to about 200 lb. per sq. in. The stress pattern in the plate around the staybolts shows the stress concentration at the staybolt holes which compresses the metal at the outermost thread. Leakage starts when the compressive forces are relaxed on reducing the pressure.

This apparently explains the cause of copious leakage which occurs in the side sheets of some fireboxes upon cooling down and which are generally referred to as "cold leaks". The same forces at work both in the test pieces and in the boiler relax the compression on the outer thread; in the test assembly the effect is due to the reduction in temperature.

The buckling of the side sheets may be augmented by the thrust transmitted through the combustion chamber and rear tube sheet when the tubes increase in temperature at a faster rate than the barrel of the boiler. An example of this was found in 20 Santa Fe type locomotives on an eastern road that leaked so badly on cooling down that water cascaded onto the floor of the enginehouse. The leaky condition was largely eliminated by a change to rigid type staybolts in the side sheets which in effect stiffened the assembly and reduced the overall deflection by transferring a large portion of the load to the staybolts.

Broken Staybolts

For want of a better expression, "corrosion fatigue" may reasonably be used to explain the cause of broken staybolts, though in the popular conception of the two terms neither corrosion nor fatigue seem to be involved. Except in rare cases the bolt does not appear to have lost an appreciable amount of metal through corrosion at the break. Nor has it been subjected to the millions of stress reversals such as occurs in the case of axles, crank pins, piston rods, and the like which we generally imply to be a requirement for fatigue failures. Corrosion fatigue does not require the loss of any grea amount of metal by corrosion and, if the level of re peated stress is high enough, the number of repetition to cause failure need not be the large number usuall associated with corrosionless fatigue.

The particular type of corrosive action that bring about the failure of a staybolt is always associated wit unduly high localized bending stresses and whether or n the action takes place coincident with maximum stre or over relatively long periods under low stress or eve at rest as a result of corroded notches acting as stre raisers, the mechanism does not alter the final resu Bolts break under the conditions of stress and corrosio found in locomotive boiler fireboxes.

As it does not seem practical to eliminate the co rosive action of the boiler water, the cure for broke staybolts lies either in the use of a staybolt materi that is not affected by the boiler water or in reducin the bending stresses to a value which ordinary ma terials are able to withstand under the conditions en countered. The latter course has been applied on thi continent, the former abroad.

The universal use of iron and steel staybolts in th country and Canada which are articulated in the out side sheets by means of a ball-and-socket joint ha proved effective, except in a few instances, in preventing the breakage of these staybolts by reducing the bending stresses. The dangerous section of a rigid staybolt i at the thicker outside sheet. As long as the ball-and socket joint remains free, the bending stress at thi location is reduced virtually to zero. And the bend ing stress at the fire sheet is theoretically reduced t half that of the rigid staybolt by doubling the effective length of the beam now acting as a simple cantilever

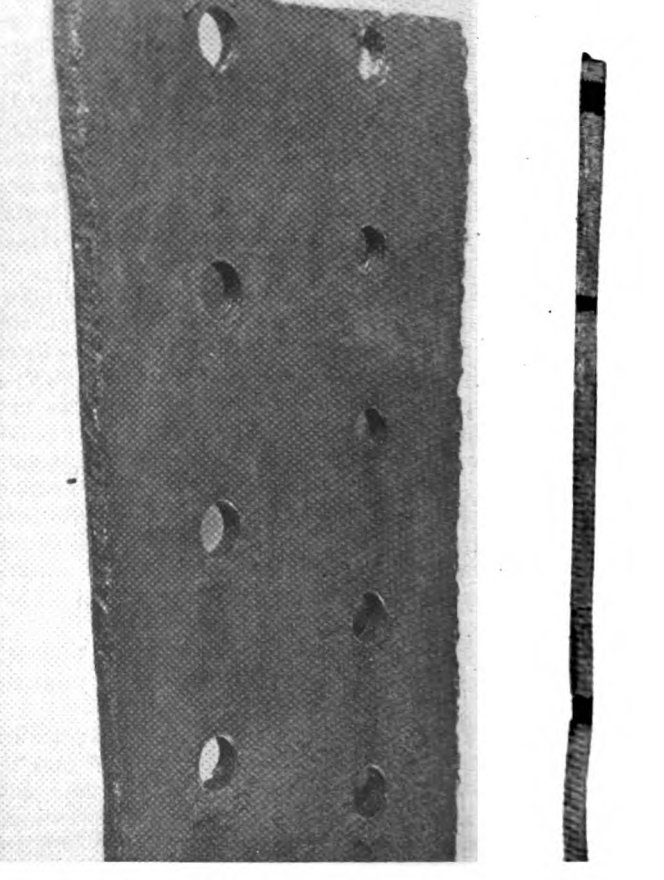


Fig. 1—Excessive corrugation

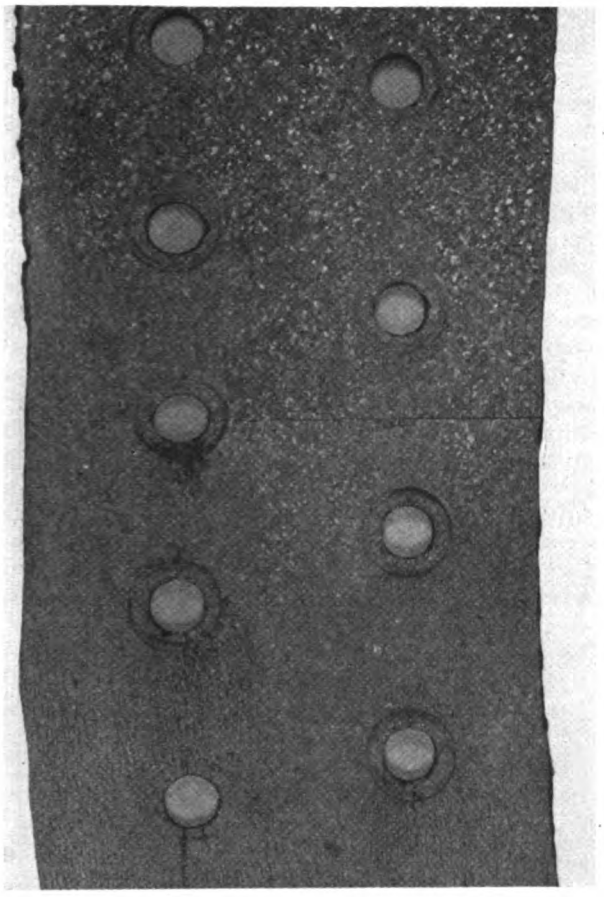


Fig. 2(a)—Fireside cracking

with all the load concentrated at the wrapper-sheet end.

The problem of broken iron and steel staybolts was approached by the European railroads from the angle of a change in material with little or no change in staybolt design. Copper and high-copper alloys, particularly manganese copper were used extensively. Copper-clad steel was introduced but had to be discarded when rupture of the copper sheath was followed by breakage of the steel core.

Monel was first tried in Europe in 1910 for staybolts. Its use progressed to a point where prior to the present war rigid Monel staybolts in breaking zones and complete firebox applications paralleled the use of articulated bolts on this continent.

The Influence of Design

The present locomotive firebox seems to be the outgrowth of all the years of building boilers since Stevenson's Rocket in 1829. The designer is guided principally by certain safety rules together with the experience of his own and other roads.

Safety rules while necessary tend to be restrictive since they are usually written after the design features have been established through usage. Therefore, they fail to anticipate such changes in size and performance demands as have taken place at such a rapid pace within the past quarter century. Experience data based on cut-and-try methods are useful up to a certain point beyond which it becomes necessary to apply more of our technical knowledge of design and materials to solve problems of limitations.

The design features of the staybolted portion of a locomotive boiler are likely to continue to be based largely upon practical considerations and good common sense because of the complication in stress distribution influenced by widely varying operating conditions.

Prof. A. V. de Forest of the Massachusetts Institute of Technology has given us useful tools of "stress-coat" and the electric strain gauge to aid in determining the stress distribution between the sheets and the staybolts in elements of the structure. Stress analyses have been made on two types of staybolted assemblies. The first was made by the stress-coat method on assemblies of two rows, four staybolts per row. These assemblies together with the stress-strain diagrams made in an outside laboratory prior to the work done at M. I. T. are described in the proceedings of the 1941 annual meeting of the Master Boiler Makers' Association, pages 175 to 178.

Though the results obtained in both investigations are substantially in agreement it is deemed advisable in the future to use symmetrical assemblies such as in the second series of tests which are shown in Figs. 5 and 6.

An assembly with the deflection gauge in place and made ready to be placed under the ram of the testing machine is shown in Fig. 7.

In each assembly, the supported sheet representing the wrapper sheet is of plain carbon flange steel $\frac{5}{8}$ in. thick and the overhanging sheet upon which the load is applied, representing the inside or fire sheet, is carbon firebox steel surface ground on both sides to $\frac{7}{16}$-in. thick. The grinding was done to avoid errors in stress measurements due to variations in thickness and flatness. The inside spacing between the sheets, representing the water space, is 5 in.

Assembly No. 1, Fig. 5 (a), duplicates current practice with 1-in. straight rigid iron staybolts screwed through and ends riveted, spaced on 4-in. centers.

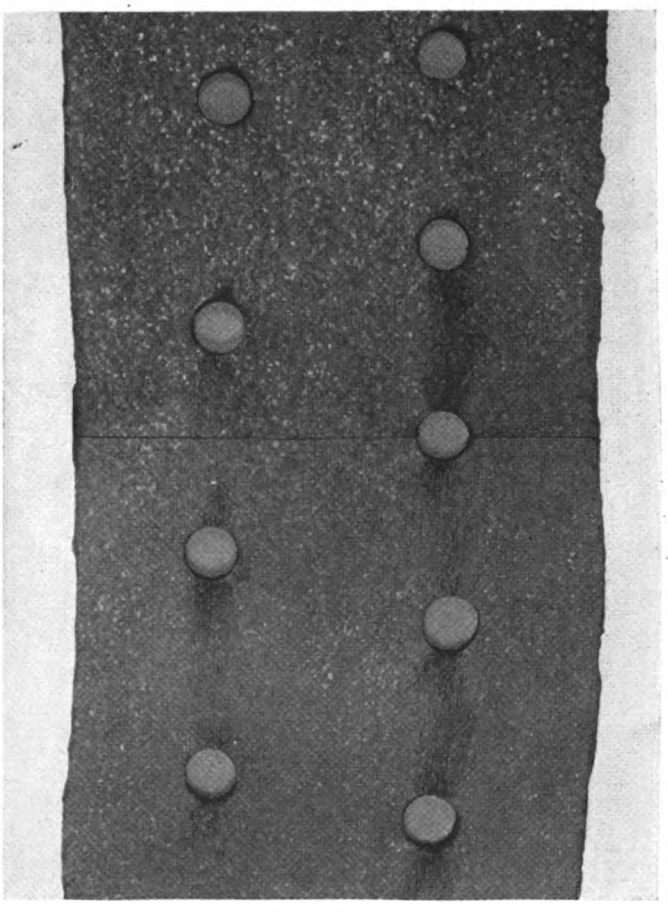


Fig. 2(b)—Waterside checking

Assembly No. 2, Fig. 5 (b), is the same except that the pattern is staggered to determine the stiffness and stress relations obtained as if the load on assembly

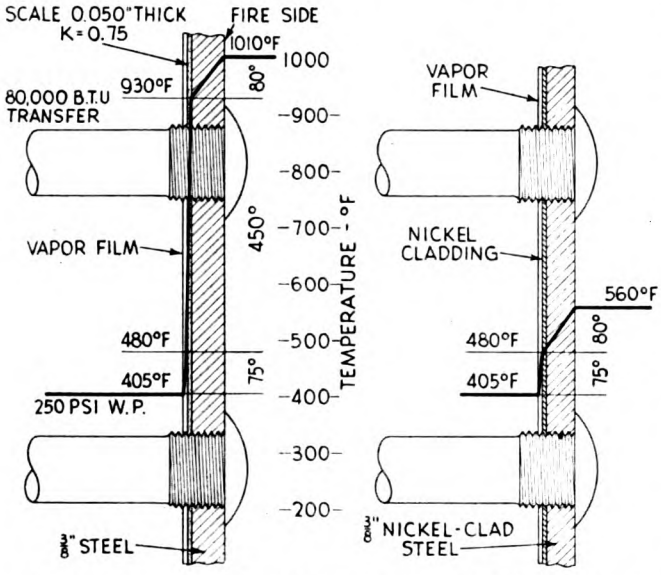


Fig. 3—Effect of scale in raising the temperature of firebox sheets

No. 1 were applied at an angle of 45 deg. to the vertical and horizontal rows of staybolts.

Assembly No. 3, Fig. 5 (c), is stayed with reduced-body Monel staybolts ¾ in. in body, diameter and 1 in. in diameter over the threads, spaced on 3½-in. centers. These were set by means of explosive charges by E. I. duPont de Nemours & Co., Inc., at its Eastern Laboratory, Gibbstown, N. J., under the direction of Dr. W. E. Lawson.

The spacing of each assembly is computed for approximately the same working pressure at equal direct tensile stresses.

A study of the load-deflection curves of assembly No. 2 shown in Fig. 8, which is typical and follows closely those of assemblies No. 1 and No. 3, gives a new conception of the elastic properties of the firebox structure in the narrow water spaces.

Measurements of side-sheet deflections made by the late G. L. Fowler and published in *Railway Age*, December 5, 1919, pages 1088-1094 under the title "Deflections of Staybolts in Locomotive Boilers" show that on standing tests in firing-up from room temperature and cooling down to room temperature a total deflection as high as .050 in. was observed. Under the more severe road conditions it seems logical to assume for design purposes that the deflection may reach a value say 50 per cent higher or .075 in.

The proportional limit of the staybolt material is reached the first time the boiler is brought up to full

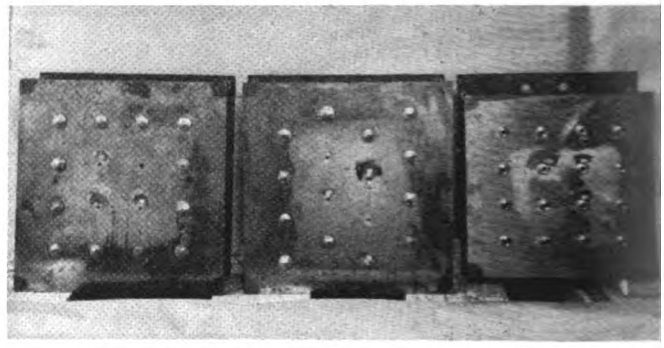


Fig 5—Staybolted assemblies for strain-gauge testing

steam pressure at a deflection of only about .025 in. though the side sheet may deflect a total of .050 in.

A permanent set of .010 in. under these conditions may be expected as shown in the curve of the first test, Fig. 8. Likewise, a second cycle exceeds the new higher proportional limit at about .036 in. deflection to give an additional permanent set of .007 in. and further strengthening of the material through cold work.

It is obvious that, since locomotive fireboxes continue to give service sometimes for long periods of time, our conception of design in respect to the physical properties of staybolt materials, factors of safety of the usual order of ¼ to ⅕ the ultimate tensile strength, endurance limits, and the like must be revised to allow for a certain amount of over-stressing as a normal operating condition. This problem can be approached with confidence in the light of the information we now have available from service records and laboratory studies.

The advantage of smaller diameter staybolts with correspondingly closer spacing as compared with current staybolting practices is clearly shown in Fig. 9, the stress-deflection relations of the three assemblies. The stresses were calculated from measurements made with electric strain gages. These are the stresses in the plate at an average distance of about 3/32 in. from the edge of the hole. The concentrated stress at the edge of the hole where cracking starts may be two or more times these measured stresses. The measured stresses of 19,300 lb. per sq. in. and 21,300 lb. per sq. in. at 0.40-in. deflection for the assemblies stayed with 1-in. iron staybolts may be increased to stresses of the order of 38,000 to 42,000 or higher as concentrated

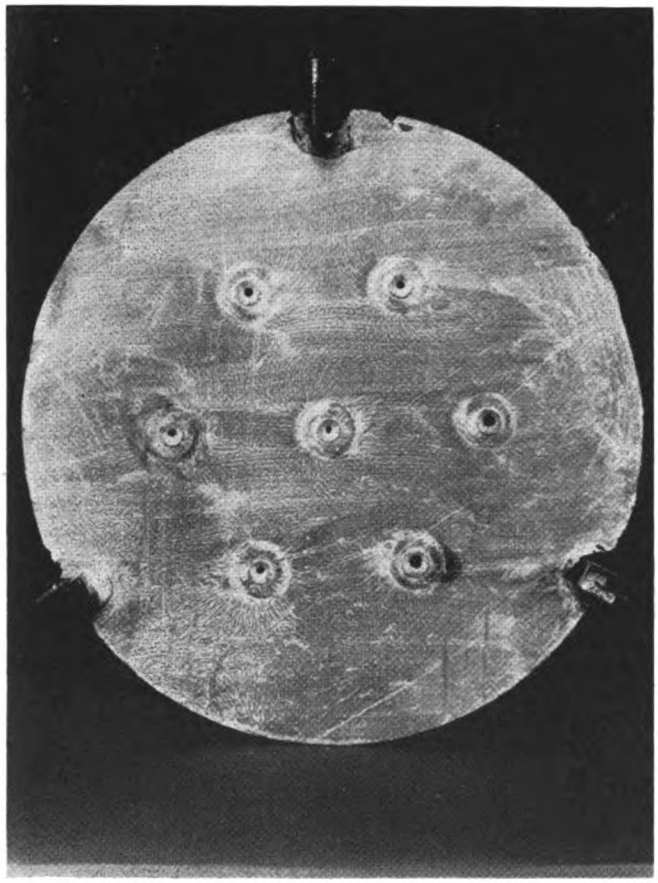


Fig. 4—Assembly for testing the effect of permanent distortion of sheets on staybolt tightness

stresses at the edge of the hole. These are reduced to less than half by the change to the smalled staybolt in assembly No. 3.

The added load on the staybolts and firebox sheets imposed by the thrust of the tubes and combustion chamber may reach values large enough to cause an already overloaded firebox to buckle and fail prematurely. A small part of the increased length is taken up by flexure of the front tube sheet and a larger part by the sagging of the tubes but, when an increase in length of a 20-ft. tube may reach values of ⅛ in. or more depending on the scale and the rate of heat transfer, some means to reduce the thrust such as expansion rings in the combustion chamber should be considered.

With the presence of overheating due to scale, high stresses, and the accelerated corroding action of boiler water concentrated at leaks, cracked sheets will continue until corrective measures are taken.

The Influence of Staybolt Fitting Practice

The efficiency of the staybolt fastening, particularly in the side sheets, in maintaining tightness against leakage is an important factor in the life and maintenance of fireboxes. The load on the staybolt fastening has increased over the past 20 years or so with the increase in the size of the boxes, in firing rates, and thermal strains from shortened periods for turn-around, dumping, washing and firing-up. As a result, the old method of applying bolts by screwing through and riveting over does not provide a joint strong enough to carry the load with a sufficient margin of safety.

Assuming a good fit in the threads only the outside thread or thread and a half at best is made tight by driving. Tightness of screwed joints in a fastening for firebox service required to withstand severe flexing is obtained by a direct compressive force and, to be effective, all of the engaging threads should be compressed.

Consideration must be given to the strengths and the elastic properties of the staybolt and sheet material.

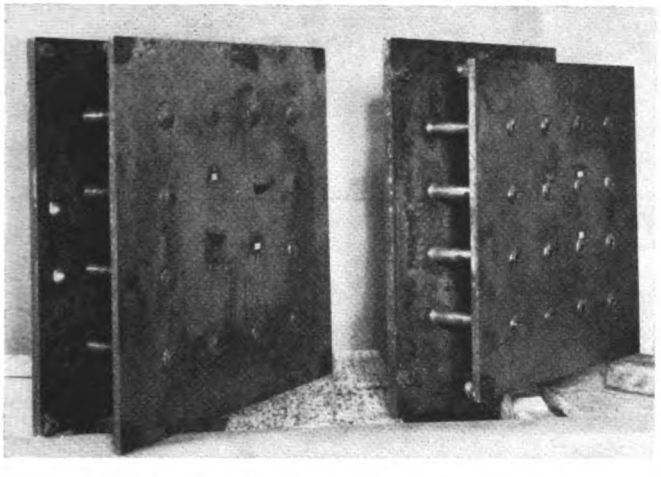


Fig. 6—Another view of the assemblies for strain-gauge testing

The sheet should have a higher elastic strength than the staybolt in order to grip the threads properly. However, good joints can be obtained with sheets of slightly lower properties than the staybolts if all engaging threads are under compression.

A tentative rule might read: "The yield point of the firebox sheet shall not be less than the yield point of the staybolt". An example of bad practice would be the use of staybolts having a yield point of 50,000 lb.

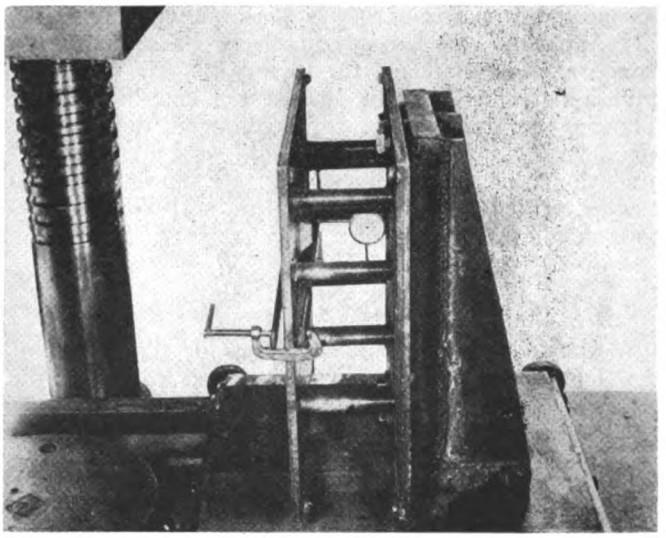


Fig. 7—Staybolted assemblies ready for testing

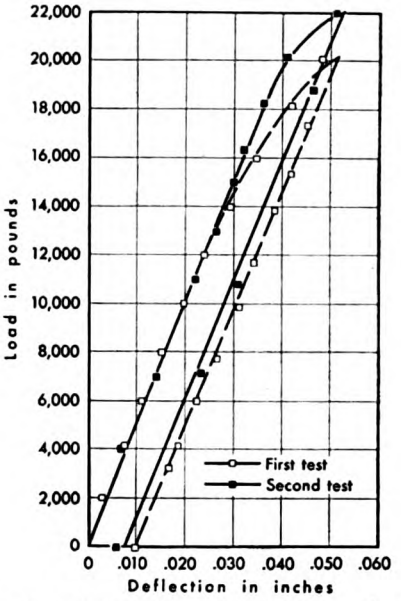


Fig. 8—Load-deflection curve of test assembly No. 2

per sq. in. expanded into a sheet of 30,000 lb. per sq. in. yield point. In this case, the soft plate will expand plastically to a greater degree than the staybolt to give a fit looser after driving than before if the bolt is expanded to a considerable degree. This is the same effect that is obtained in over-rolling tubes.

An effective method is in use abroad for expanding staybolts throughout the thickness of the sheet by drifting enlarged holes in the ends of hollow bolts. This type of stay is reported to provide a permanently leak-tight joint. It is, however, comparatively expensive to manufacture.

To offset the additional costs of enlarging the holes in the ends and machining the bolt from over-size bars experiments are being conducted in this country using explosive charges to expand standard reduced-body staybolts. The same effect in expanding all engaging threads is obtained as with the drifted bolt.

An alternate method for making permanently tight joints which is immediately available subject to the approval of the I. C. C. is through the use of seal welding. The following procedure is suggested: (1) Provide staybolts of such length as to give an extension

beyond the fire sheet of $\frac{3}{32}$ to $\frac{5}{32}$-in. after hammering, (2) Apply the screwed stay in the regular manner and to the existing standard for thread fits, (3) Hammer with a flat snap straight against the end of the bolt following regular practice for holding on, double gunning, or bucking-up and, (4) Seal weld by approved practice in lieu of heading. Fig. 10 shows a recommended procedure for driving and for seal welding staybolts on the fire side.

Designing New Boilers

In the following recommendations for the design of new boilers a definite move is suggested leading to the

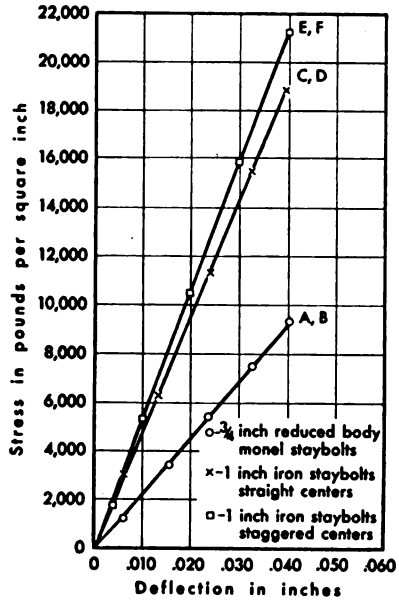


Fig. 9—Stress-deflection relationship of the three test assemblies

use of smaller diameter staybolts on closer centers than those now in current use.

1—Limit the diameter of staybolts in all locations where the water space is 10 in. or less to $\frac{7}{8}$ in. dia. for both straight rigid and reduced-body stays.

2—Limit the spacing to yield a gross unsupported area not to exceed 14.06 sq. in. which is equivalent to a square $3\frac{3}{4}$-in. by $3\frac{3}{4}$-in.

3—Compute the stress in the stay due to boiler pressure to as near a maximum of 7,500 lb. per sq. in. as practicable.

With the above limitations in mind the narrow water space in a boiler operating at 285 lb. per sq. in., for example, would be stayed with $1\frac{3}{16}$-in. by $1\frac{1}{16}$-in. reduced-body stays, drilled with $\frac{7}{32}$-in. telltale holes, spaced to a gross unsupported area not to exceed 13.38 sq. in. or very slightly over $3\frac{5}{8}$-in. by $3\frac{5}{8}$-in.

For a boiler pressure of 250 lb. per sq. in. under the limitations suggested above, the narrow water spaces would be stayed with $1\frac{3}{16}$-in. by $1\frac{1}{16}$-in. stays spaced not to exceed 14.06 sq. in or $3\frac{3}{4}$ in. by $3\frac{3}{4}$ in. A better construction with longer life expectancy would be obtained with $\frac{3}{4}$-in. by 1-in. stays spaced not to exceed 12.74 sq. in. or very slightly over $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in.

4—Until such a time as a better and cheaper method is found, seal weld all staybolts on the fire side at the time of application subject to the approval of the I. C. C.

Those fearful that by seal welding the crown stays the force of an explosion due to low water is increased should equip the firebox and combustion chamber with syphons or other types of circulators which have proved safe in limiting the area of dropped crown and hence the rate of steam liberation to below that necessary to cause an explosion.

5—Use Monel reduced-body rigid staybolts in all locations where normally iron or steel stays equipped with a ball and socket joint at the outside would be applied.

6—Use nickel-clad steel side sheets and other firebox sheets if overheating due to water scale is experienced with similar classes of power operating under like conditions.

7—Side sheets and preferably the entire firebox should be of steel having a tensile range of 70,000 to 82,000 lb. per sq. in. This applies likewise to the steel base of nickel-clad steel.

8—Expansion rings rolled inward should be provided in the combustion chamber.

It is apparent that a need exists for modernizing the locomotive boiler to meet the demands of present-day operating conditions. Firebox failures are seriously hampering the war effort in the loss of locomotive time out of service for repairs, the consumption of materials urgently needed for other purposes, and the use of man-hours of skilled labor that could be applied to better advantage on other work. Improvements now in the interest of the war effort will react favorably in the post-war period, primarily in reducing the operating costs of locomotives, and improve the competitive position of railroads using steam locomotives.

It can be confidently stated that through minor changes in design, and through the use of better materials

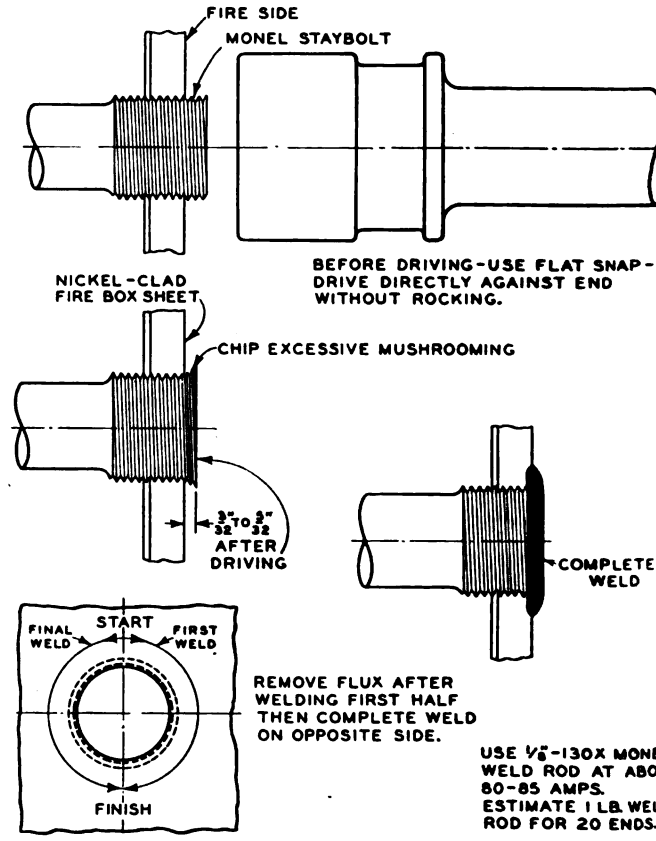


Fig. 10—Recommended procedure for driving and seal-welding staybolts on the fire-side

properly applied, a very considerable economy in firebox maintenance cost can be realized and the desired increase in locomotive time on the road can be obtained.

Application, Maintenance and Blowing of Flues and Tubes



E. H. Gilley,
Chairman

Few changes in practice developed during past year—Prevention of necessity for maintenance the goal—Pressure cleaner for flues described

Application of Flues and Tubes

The method of flue and tube application today is practically the same as that used since the advent of the steam boiler. True, tools have changed with the times and more progressive and simplified operations have been devised, but the fundamentals are the same. Flues and tubes are set to length in the back tube sheet, flared, rolled, or prossered and beaded. Flues and tubes may be applied with or without copper ferrules and the seal welding of the beads to the back tube sheet depends upon service requirements and water conditions.

When measuring over tube sheets for the length of flues and tubes it is well to take a sufficient number of measurements to insure getting the average length, allowing tubes to be ½ in. longer than the distance over the sheets and flues ⅝ in. longer. This allows sufficient material for beading at the back tube sheet and flaring at the front tube sheet. Flues and tubes should be cut accurately to length and, before they are placed in the boiler, care should be taken to see that ends are clean and smooth and all scale and burrs removed.

In the preparation of a back tube sheet, when holes become 1/32 in. out of round, they should be reamed with a straight reamer and have a copper ferrule applied. The outside diameter of ferrules should be of the same size as the flue and tube holes, and ferrules should be set into the tube sheet 1/32 in. from the fire side and tightened in the holes by using straight sectional expanders and flaring on the water side.

Set flues and tubes to length in the back tube sheet and flare with a standard flaring tool, prosser with a standard sectional expander using No. 60 riveting hammer. The expander mandrel should be driven into the expander until the flue or tube is tight against the sheet, then slacked off and the expander turned slightly in the flue or tube and driven in again. This should be repeated three times or until flue or tube is properly set and evenly expanded in the sheet. When all flues and tubes have been prossered in the back tube sheet, they should be rolled in the front tube sheet, using a standard roller expander, and such flues and tubes as require it should be beaded in the front tube sheet in accordance with standard practice. The boiler should be tested before flues and tubes are beaded in the back tube sheet to insure their being properly and evenly expanded and that they do not leak. Bead flues and tubes with standard beading tools, taking care to see that nothing enters between the bead and the sheet.

If flue and tube beads are to be seal welded to the tube sheet, the beads and tube sheet should be sandblasted to remove all scale, oil and grease, insuring a clean welding surface, when all flues and tubes are welded, the flues and intermediate tubes should be welded first, and then the tubes, in accordance with the standard welding practice of the railroad.

If tubes are not seal welded, they should be given a light rolling after beading to rectify any lifting of the tubes that might have occurred in the beading operation.

Maintenance of Flues and Tubes

The question will naturally arise as to why maintenance is necessary if a good application of flues and tubes was made in the shop, adequate water treatment with definite road and terminal blowdown schedule maintained, proper terminal handling, both inbound and outbound, given and in the absence of, or with the minimum amount of, cinder cutting. We may assume that the necessity for flue and tube maintenance can be attributed to any one or a combination of the above definite factors, which, if neglected or improperly performed, will result in the unnecessary reworking of the flues and tubes, shorten their life and, perhaps, lead to serious flue or tube failure. We are, therefore, interested in the prevention of flue and tube maintenance rather than in the maintenance itself.

The prevention of flue and tube maintenance is, in most respects, largely a matter of supervision and engineering. The present manpower shortage has seriously affected the railroads in that the younger mechanics and apprentices have been called into the armed services, the helpers have been set up to mechanics, and they have been replaced, in part, by older men and women. The supervisor has been called upon to train and break in these new men and women as well as to maintain increased supervision responsibilities due to heavier repair programs and the placing in service of older locomotives which ordinarily would have been retired, or perhaps scrapped.

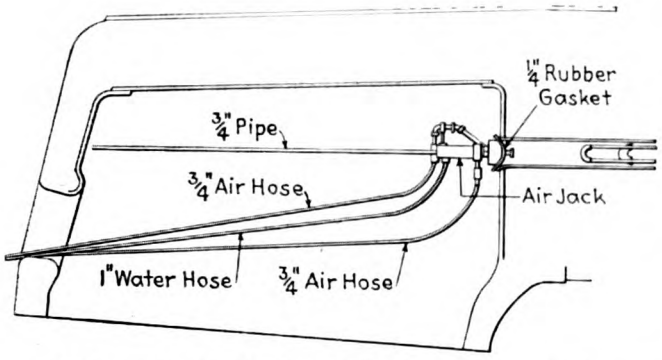
A majority of our railroads have a standard practice covering all or most of the repair and maintenance operations. This is particularly true of flue and tube application and, no doubt, covers all tools used, both as to design and permissible tolerances and methods of performing each operation in the setting, prossering, rolling, beading and testing.

Treating of boiler feedwater is primarily the responsibility of the water service engineer. Road blowing of locomotives to maintain the desired ratio of dissolved solids is a function of the road foreman of engines or traveling engineer, while the schedule of terminal blowdowns is the direct responsibility of the locomotive foreman, boiler foreman or boiler inspector, each of whom should be fully conversant with, and able to analyze the boiler waters to maintain the desired alkalinity ratio with respect to dissolved solids.

Terminal handling of locomotives has a very definite part in flue and tube maintenance. The drop in temperatures when cleaning or dumping fires at the cinder pit, loss of time in handling the locomotive between

the cinder pit and the house, heavy and prolonged use of the blower at the cinder pit or in the house, too rapid blowing down of the boiler at washout periods and quick build up of steam pressure on the dispatch track, are all the responsibility of the supervisor.

Cinder cutting has been the direct cause of most of our flue and tube maintenance and has been responsible for some very serious flue and tube failures in which injury to employees has resulted. Cinder cutting is the result of high draft and the necessary high firing rates to get maximum capacity from the locomotive and is influenced by the resistance of the superheater units and front-end appliances to the free flow of gases. A decrease in cinder cutting can only be brought about by reducing the loss of unburned fuel and decreasing the draft velocity. This is a problem for the engineers. We, however, as master boilermakers, are confronted with the necessity of maintaining rigid inspection of and making costly repairs to the parts affected by the cutting action of the cinders.



A shop-made device for cleaning flues and superheater units

The whole subject of flue and tube maintenance, therefore, is prevention of the necessity. Do your standard practices fully cover present-day requirements and are the employees under your supervision working in strict accordance with such standard practices?

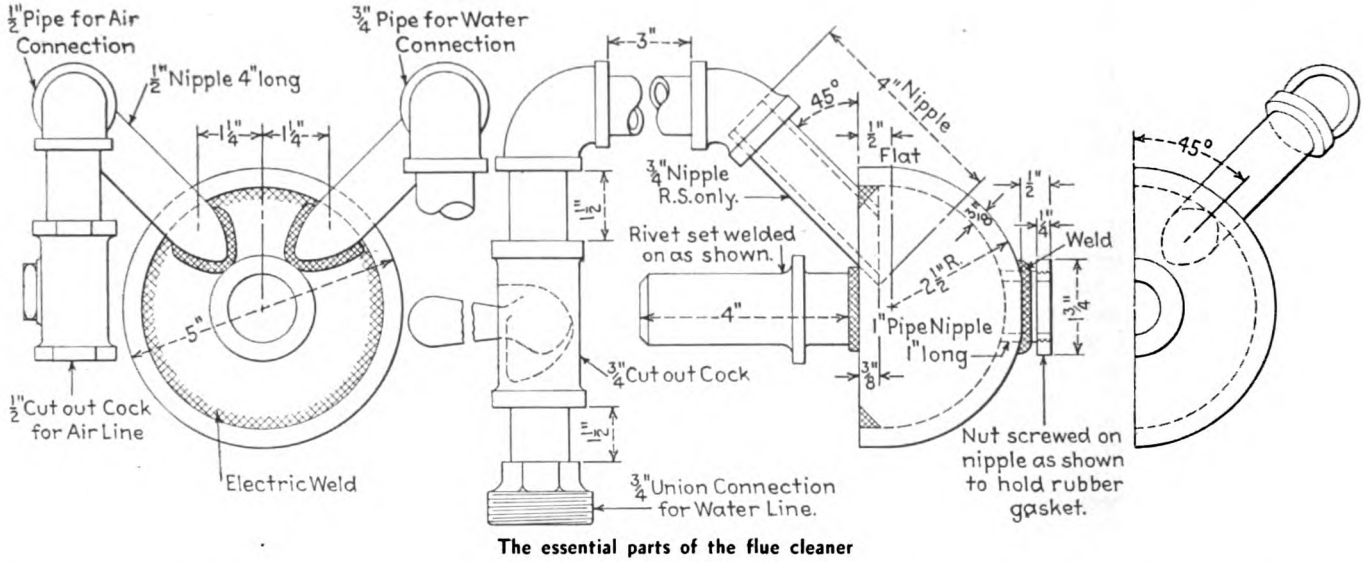
Blowing of Flues and Tubes

Modern high-pressure locomotives are now equipped with automatic soot blowers and, if operated on the road by enginemen in accordance with instructions of one to two minutes' operation each hour while running, drifting or standing; and by the cinder-pit crew when fires are dumped or cleaned, they will maintain flues and tubes open and free of soot and cinders. They will assist materially in preventing slag build-up on superheater unit return bends, honeycombing of tube sheets, flues and tubes, and will eliminate to a great extent the blowing of flues and tubes by the enginehouse forces.

Coal-burning locomotives, not equipped with soot blowers, should have flues and tubes blown and the slag removed from superheater unit return bends each time the fire is dumped. At washout periods individual attention should be given to each flue and tube to insure its being open and free of soot and cinders. Any cinder accumulation in the smokebox at the front tube sheet should be removed.

With the present service demand, and at the high speeds locomotives are now operating, it is not unusual to find from one to ten flues or tubes completely blocked. In some instances the use of an auger is required to open up the flue or tube to permit entering the flue blower pipe which should be used in each flue and tube and should be of sufficient length to extend one foot beyond the end of the flue or tube into the smokebox.

Flues and superheater units may be thoroughly cleaned at washout periods by washing under pressure. A device whereby this may be accomplished is made of a hollow half ball having a ½-in. diameter nozzle in the ball end to which is attached a rubber gasket of the same overall diameter as the half ball. Air and water connections are made to the flat side of the half ball and a mandrel is fastened to it for attaching an air jack. The ball is placed over the firebox end of the flue and is held securely in place by means of the pressure exerted by the air jack. The rubber gasket prevents backing up of the water into the firebox while the flue is being washed. The combination of both water and air pressure thoroughly cleans the interior of the flue and the exterior of the superheater unit, and where this method of washing the flues is used it is possible to go from washout to washout without any additional attention to the flues.



The essential parts of the flue cleaner

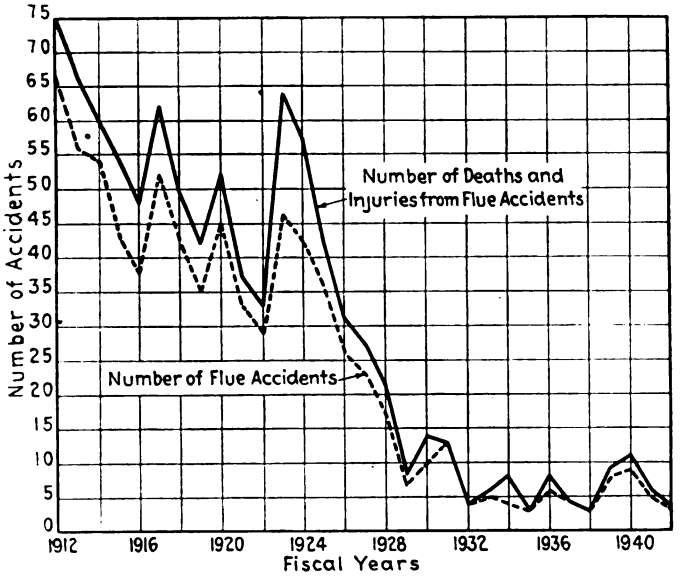
The report was signed by E. H. Gilley (chairman), general boiler foreman, Grand Trunk; I. N. Moseley, general boiler maker, N. & W.; R. A. Culbertson, district boiler inspector, C. & O.; A. P. Lieder, general boiler inspector, Michigan Central; L. D. Prior, regional boiler inspector, B. & O.; William Henry, general boiler inspector, Can. Pac.; H. A. O'Neil, district inspector, Interstate Commerce Commission; E. Crapper, chief boiler inspector, Argentine Railways.

Maintenance of Tubes and Flues for Safety

The situation has improved since 1911—Still opportunity for further reduction in number of preventable accidents

[Accompanying the report of the Committee on Topic No. 4—Application, Maintenance and Blowing of Flues and Tubes is a paper by H. A. O'Neil, district inspector, Interstate Commerce Commission, dealing with the effect of the locomotive inspection law on the number of accidents and casualties caused by failures of tubes and flues. The following is taken from Mr. O'Neil's paper.—EDITOR.]

In the railroad industry for many years, apparently intentionally and deliberately, we condoned the existence and continuance of locomotive practices and methods that were neither economical nor safe. This refers to



The decline in the number of accidents and injuries resulting from flue accidents since the enactment of the original Locomotive Boiler Inspection Act

the days when the poorer engines were invariably sent to outlying points; when workmen, in many cases, through pressure or threats, were forced to perform grossly improper and unsafe repairs. Even employees themselves made repairs or employed practices that were improper and unsafe. It appeared then that the practice of putting engines into service regardless of their mechanical condition provided the wheels would turn and regardless of efficiency, safety or economy was regarded as an indication of real accomplishment by those responsible.

Even as late as 1910 very little was known by the railroads concerning the extent of accidents. Unfortunately, the records show that to correct this, to promote and insist upon safety, it became necessary to enact stringent national laws. The Locomotive Inspection Act was first enacted on February 17, 1911. Its object as stated in the preamble was: "An Act to promote the safety of employees and travelers upon railroads by compelling common carriers engaged in interstate commerce to equip their locomotives with safe and suitable boilers and appurtenances thereto."

During the first year of the law there were 66 flue accidents which, presumably, or at least as far as is known, was an average yearly number. The reduction of flue accidents from the above figure to an average of only four or five per year was effected by the law. Another indication of general improvement is shown by the fact that thirty years ago 5,000 to 25,000 miles per engine failure was common, while today 100,000 to 200,000 miles per engine failure is not uncommon on some railroads.

Before the enactment of the Locomotive Inspection Law it may have been legitimate to plead ignorance as an excuse for responsibility, but it would seem that such pleading should have long since been unacceptable. What, then, can be used to justify the unwisely used authority apparently executed by some one which was responsible for the following accident which occurred in 1940, 29 years after the law went into effect: "Superheater flue broke off near back flue sheet, due to excessive grooving on the water side; flue reported leaking on June 12, 26 and 27, and July 3, and on July 6 before the accident the boiler foreman reported: 'I recommend engine be removed from service account bad flues.' One injured." Was it economical; was it safe, or was it efficient to place that locomotive in service?

The accompanying chart shows in line *A* the number of flue accidents by fiscal years ended June 30 from 1912 to 1942. Line *B* shows the number of deaths and injuries caused by those accidents.

It would appear that for the period of the time the law has been in effect, had the number of flue accidents continued at the average per year for the first ten-year period, there would have been 1,438 accidents. Had they for the full period accumulated at the average per year for the last ten-year period, there would have been only 155 accidents. Assuming that the pre-law yearly average was approximately the same as the first ten-year average, it indicates that there were at least 41 flue accidents each year that could have been prevented by the exercise of proper care.

The committee urgently requests every member to perform all inspections, repairs, etc., so that the requirements of the law will be more than complied with; that there will be a still further reduction in accidents, and that the cause or reasons for such accidents as those listed below, all of which occurred during the past five years, will no longer be allowed to exist until they cause injuries or death:

Fire tube broke off at back tube sheet, thickness of tube reduced to 1/32 in. at point of failure due to excessive use of expander and to corrosion between tube and copper ferrule. One injured.

Flue failed at back tube sheet; flue overworked and reduced to paper thickness. One injured.

Locomotive not steaming properly; combustion chamber filled with cinders up to and including the fourth row of tubes and most of the tubes below the superheater flues stopped up. One flue and one tube leaking and caulking edge of tube-sheet combustion chamber seam leaking. Three of the four bolts missing from the diaphragm plate over the superheater header, allowing plate to swing out of place. "Clean out flues" was reported on August 3, 6, 7, 9, 12, 24 and 26 (after accident). One injured.

Superheater flue failed due to being reduced in thickness by cinder cutting. A similar flue failure occured in this locomotive two days prior to this accident. One injured.

In Spite of Difficulties

C.D.O.A. Continues to Function

Membership is built up—Reports received from practically all committees for publication in the yearbook

THE Car Department Officers' Association was organized to bring together supervisors interested in car-department matters for the advancement of knowledge pertaining to safe and economical operation, and to exchange ideas, discuss problems, promote uniformity, effect economies in car construction, maintenance and operation; also to make constructive recommendations to the Association of American Railroads. A further important function is to work with shippers to improve loading methods so that delays in shipments critically needed in these times may be avoided. The association completed its forty-second year on October 1, 1943, with 1,400 members located throughout the United States, Canada and Mexico and a drive is now being conducted to increase the membership for the period ending October 1, 1944.

The activities of the association have been carried on with difficulty during the last year owing to the pressure on car supervisors to turn out a much greater volume of high-quality car inspection and repair work with reduced forces, loss of experienced car men to military service and frequent delays in getting materials necessary for prompt repairs. Car foremen and supervisors who belong to this association have found it exceedingly difficult to attend committee meetings of any sort or in many cases even to contribute to committee reports by correspondence. It is a tribute largely to the committee chairmen that all of the reports scheduled for this year have been prepared and will be included in the yearbook.

The affairs of the association have been handled during the year by Acting President A. J. Krueger, general superintendent car department, Nickel Plate, in the absence of President Frank E. Cheshire, formerly assistant superintendent car department, Missouri Pacific, and now serving as lieutenant colonel, United States Army, Transportation Corps, commanding at Camp Millard, Bucyrus, Ohio, where railway shop troops are now in training. Vice-presidents of the association, who are holdovers from the last annual meeting, include G. R. Andersen, assistant superintendent car department, C. & N. W., Chicago; D. J. Sheehan, superintendent motive power, C. & E. I., Danville, Ill.; I. M. Peters, secretary and superintendent, Crystal Car Lines, Chicago; P. J. Hogan, supervisor car inspection and maintenance, N. Y., N. H. & H., New Haven, Conn. The present secretary-treasurer is F. H. Stremmel, assistant to the secretary, A. A. R. Mechanical division, Chicago.



A. J. Krueger, President



F. H. Stremmel, Secretary-Treasurer

A complete list of C. D. O. A. committee subjects and personnel was published in the September, 1943, *Railway Mechanical Engineer,* page 441. Some of these reports are included in the following pages and others will be abstracted in subsequent issues.

Report on Repair Methods and Shop Kinks

A review of the essential facilities for a light car-repair plant

The committee has been endeavoring to obtain descriptive matter covering additional shop kinks, similar in character and usefulness to those described in our 1941 report. However, due to the heavy increase of work on our own individual assignments and the inability to travel and make the necessary contacts, this phase of activity had to be set aside for the time being. Therefore, we submit for your consideration, a discussion of the situation with respect to shop equipment and facilities which now exist on many of our railroad light repair tracks and what we consider should be done to alleviate it.

This report pertains to those light repair tracks where only running repairs are made and a maximum of 30 to 35 men are employed.

For the most part, light repair tracks have been established to expedite loaded car movement, to condition freight cars for specific types of loading or to save movement of bad order cars over main tracks in scheduled trains. In some cases, new sources of traffic have created the need.

Many Light Repair Shops "Grew Like Topsy"

Observation indicates that many light repair shops were established without careful planning and consideration as to location and facilities required. At many points a few old box cars were set off on the ground to provide stores and locker facilities; a few tracks were laid down; some tools consisting of a few jacks, wrenches, etc., were put at the disposal of a car foreman, and a new light repair track was born. Little or no thought was given to efficiency, quality of work or production. Such establishments, and there are many, remind us of Topsy—they simply grew. If the car foreman happened to be of the industrious and aggressive type, he eventually built up the shop to a more or less workable arrangement, but the lack of foresight in planning a layout to meet the present and future needs, definitely limited his plans for expansion and improvement.

The need for providing adequate light repair facilities has never been more apparent than it is today. Heavy increases in freight movement together with a serious lack of manpower and the grave possibility of these problems increasing, brings us to the fuller realization of our predicament.

In this discussion, it is not our intention to attempt to set up specifications for a modern light repair shop; rather, we desire to set before you some of the most vital requirements common to all such shops and of which at least one or more are lacking at virtually every point. We are aware of the fact that requirements for track layout, size and kind of building, machine tools, etc., depends on the location, type of cars to be serviced, number of men, and various other circumstances.



R. K. Betts,
Chairman

The Spot System of Repairs Has Many Advantages

As we approach the question of shop track layout, we emphasize that this cannot be a standard set up for all railroads. However, if track room permits and tracks are open to switching at either end, the spot system of repairs has some distinct advantages. To mention a few, the work is concentrated in one locality which lends itself to more efficient supervision; movement of small tools is brought to a minimum; material deliveries are made quicker and with less labor; and permanent trestles, wheel-handling facilities and truck hoists may be installed. Processing the work by specialists on trucks, wood work, air brakes, steel work, etc., is also made possible and the amount and quality of work turned out are improved.

It is unanimously agreed that every light repair shop track should have paved run-ways. Light repairs to freight cars is a 365-day per year operation which, for the most part, is performed out of doors and in all kinds of weather. Dry footing for the workers and a firm roadway for shop vehicles is an absolute necessity. Pulling acetylene cutting and welding outfits, air-brake wagons or carts, rivet-heating forges and similar vehicles through mud, snow or ice is not only a difficult task, it is detrimental to good safety performance.

Careful and deliberate consideration should be given as to the size, location, arrangement and construction of shop buildings. They should be centrally located and of sufficient capacity to house the maximum forces which may be employed. Several recent installations have been made where the office, locker and wash rooms, storeroom, blacksmith shop, mill, air brake room, oil house and paint room are all under one roof. This single unit type of building has some distinct advantages which are well worthy of consideration. Plumbing, lighting and heating facilities may be installed at a minimum cost and subsequent economical maintenance is possible. A central heating plant saves fuel and reduces fire hazards. The building or buildings should be of fireproof construction such as concrete block, asbestos sheathing or brick. Office, locker and wash rooms should be well ventilated and lighted and so designed that a sanitary condition may be maintained at all times.

Importance of a Properly Equipped Blacksmith Shop

The blacksmith shop equipment should include a forge, anvil, face plate, bolt-threading machine, double grinder, drill press and straightening press of suitable capacity for light work. Our blacksmith shops have been virtually indispensable in the reclamation of material during this war emergency.

While the modern freight car is principally of steel construction, many thousands of composite wood and steel cars are still in service and the necessity for wood-working machinery cannot be overlooked. The mill room should contain a band saw, cut-off saw and possibly a small planer. One of the new types of portable power saws should prove a valuable asset.

The installation of air-brake test racks, journal-truing lathe, brake-beam repair devices and similar shop machinery is optional. Many railroads have inaugurated the policy of performing wheel work, brake-beam repairs, air-brake valve repairs, etc., at central points strategically located and have found that this arrangement has many distinct advantages.

The small-tool complement will vary with the type of work and class of cars being repaired. However, there are several units that should be included in all light repair track equipment. We believe that power jacks for raising and lowering loaded cars tops the list. In comparison, hand operated jacks are obsolete, except those of light capacity which are used in jacking empty cars. Furthermore, the efficiency of operation and general safety features makes them almost indispensable. Other small tools, such as air hammers of various capacities, wood and steel boring drills, push and pull jacks, power safety saws, air-brake testing devices, truck hoists, steel trestles and ladders, acetylene and electric cutting and welding units and many others should be included. In addition to these, there are numerous home-made shop devices for specific types of work which should not be overlooked. Previous reports have stressed this feature in particular.

Crane-Type Tractors a Great Help in Car Work

In conjunction with the paved run-ways, we are more than favorably impressed with the use of crane-type tractors. They are very flexible and the operations which can be performed with them are being increased with experience. Their use eliminates the need for material delivery tracks altogether. Heavy material, such as wheels, couplers, truck side frames, truck bolsters, etc., can be transported quickly from stock to the car and excessive strain and lifting by the repairmen and laborers is reduced to the minimum. The crane type tractor is also used to load and unload carloads of material which would otherwise be handled with cranes and the need for their installation is dispensed with.

Other items worth consideration are overhead air lines, electric cables and outlets for electric tools, flood lighting for night work and drinking water facilities. The outlets of these facilities should be placed near the repair tracks where they would be readily available to the employees.

Air lines should be provided with modern valves and leak-proof connections and provision should be made for expansion and contraction, preferably by welded expansion loops. In fact, the entire line should be of welded construction. An electric air compressor of ample capacity, with air storage tanks so located as to maintain a balanced pressure, is essential. First-class rivet work cannot be performed without full specified air pressure.

At points where numerous box cars are cleaned on the repair tracks, the installation of an incinerator would be advisable. Nothing tends to make shop premises more unsightly than paper and other rubbish lying around and being blown about by every gust of wind that comes along.

This subject is of sufficient importance to warrant full investigation on our railroads. We must look ahead into the future and provide better and more facilities for the railroad men of tomorrow.

The report was submitted by R. K. Betts (chairman), foreman car repairs, Pennsylvania.

Inspection and Maintenance of Freight Cars



H. E. Wagner,
Chairman

Recommendations for further action to reduce delays to commodities en route

A. A. R. Mechanical Division General Committee instructions, file GC-1006, were sent out, under date of September 24, 1941, calling attention to needed action to reduce delays to commodities en route. On December 22, 1941, another circular was issued, under the same file, acknowledging the establishment of committees at the important shipping centers and some improvement in conditions set forth in the original circular. However, in reviewing the minutes of these meetings it was found that conditions had not yet improved to the extent anticipated and everyone was urged to intensify his efforts to bring about the desired results.

That their issuance was timely and the recommendations contained therein well founded is evidenced by the findings of this committee, in an analysis of reports submitted by several of the local committees.

The original circular brought out that some of the items listed below required attention as, from reports being received, important freight was being delayed due to failure of supervisors to follow up these matters as closely as the war emergency justified.

1—Selection of cars in proper state of repair and of suitable types for loading.

2—All bad-order empty cars to be repaired to the extent so that they may reasonably be expected to carry their lading to destination without delay enroute for repairs or transfer.

3—Improper loading of cars, i. e., failure to comply with the rules governing the loading of commodities on open-top cars and general rules one to five governing the shipments of freight in closed cars.

4—Shopping of loaded cars for repairs or adjustment that could be safely operated to destination.

5—Failure to comply with interchange Rule 60 in the maintenance of air brakes.

6—Failure to comply with interchange Rule 63 in the renewal of worn brake beams, hangers, pins, bolts, etc., and the application of bottom-rod and brake-beam supports as required in Interchange Rule 3.

7—Improper servicing and repacking of journal boxes as outlined in Interchange Rule 66.

8—Maintenance of trucks, couplers, and draft gear.

9—Expedition of repairs to freight cars, both loaded and empty, to reduce detention time in bad order to a minimum.

Committees were appointed at the important shipping centers and began making inspections of all local facilities, with the view of correcting conditions, in October, 1941. Reports submitted by them, some of which this committee had the opportunity to see, indicated that in many cases there was much room for improvement.

Reports have been submitted covering innumerable cases of open-top loads failing to comply with the loading rules, the principal commodities being steel, pipe, poles, lumber, etc. After reviewing the exceptions found in the reports available, it is evident that the job is still not being satisfactorily done and it would be our recommendation that consideration be given to analyzing conditions at principal repair points to determine:

1—That adequate supervision has been furnished.

2—That all supervisors have been properly instructed to present-day requirements.

3—That through the medium of periodical meetings, questionnaires, etc., employees be given the opportunity of becoming thoroughly familiar with their assigned duties.

4—That the activities of present mechanical committees be increased to such extent that enough inspections will be made to determine if conditions found on original inspection trips have been corrected. Current reports do not reflect that this is being done.

This committee submitted a report to the association during 1942, entitled "Minimum Detention of Cars in Bad Order." Included in that report was a suggestion that the association go on record as favoring the use of a standard form to cover bad-order cars, to enable all supervisors to familiarize themselves with their detention time. That such information is essential is evidenced by the number of cases reported where bad-order cars were unnecessarily delayed and we believe this should again be submitted with the view of bringing about corrective action.

The report was submitted by H. E. Wagner (chairman), master car builder, Alton & Southern.

Passenger Shops and Train Yards



C. P. Nelson,
Chairman

Train yards carry heavy load—Practical suggestions for conserving manpower and material

The lack of manpower, particularly trained and skilled mechanics, as well as essential materials has given car-department officers grave concern in the endeavor to keep rolling stock in proper repair and free from failures. On account of the demand for passenger-carrying equipment, including mail, baggage and refrigerator cars. the regular shopping schedules are again being deferred, comparable with the lean years of the recent depression and as a result a greater burden is thrown upon the terminal yard forces for the various classes of maintenance. The inability to take equipment out of service for the time required to complete general repairs has resulted in the setting up of what might be termed a light general shopping program, the work consisting of a general overhauling of trucks, draft gears, air brakes and a general clean up, performing whatever paint touch-up work is necessary. In this manner, cars are out of service for only a few days and kept "rolling" in a safe and presentable condition.

Management has found it necessary to convert a large percentage of special equipment such as lounge, dining, parlor, observation and even business cars into coaches in order to meet to some degree the demand for increased seating capacity. In some instances, the lounge and smoking rooms in coaches and chair cars have been dispensed with in order to provide additional space for the regulation type coach seat. Also, some of this so-called luxury equipment has been converted into work cars, equipped with benches and used for plant transportation. A large number of box cars have been remodeled into work, bunk and shower-bath cars for various purposes. While some of these changes in equipment appear to be somewhat drastic, nevertheless they are essential and in keeping with the part railroads take in the war effort. Then, too, in making these changes some conception of post-war requirements must be formulated.

The maintenance of passenger equipment in shops and train yards is proving quite a problem, keeping in mind that there is a certain quality and standard to maintain. Supervisors are being called upon to use their ingenuity in devising ways and means to meet their various problems. With the loss of many skilled mechanics through enlistment or induction into the armed forces supervisors have been charged with the responsibility of promoting helpers to the positions and then training these men along with new men to a point of reliability and efficiency. Vacancies for helpers, car cleaners and laborers are being filled in the majority of cases with boys, old men and women, and they also require extensive training. They must be acquainted with the safety rules and thoroughly instructed in accident prevention activities, for, after all, injuries and absenteeism are non-productive. Managements have endeavored to purchase tools, machines and other equipment to place at the disposal of shop and yard forces in order to increase production and conserve manpower. A great many of these facilities are not now available. however, and another bottleneck is encountered.

Practically all of the materials used in the maintenance of passenger equipment comes under the category of vital war materials, a large number of which cannot be obtained. On the contrary, the few materials that can be obtained are finally delivered after considerable delay. Therefore car-department officers and supervisors are confronted almost daily with the task of finding some substitute or investigating new means of reclamation.

The shortage of labor and material is our chief concern for the duration and it is with this thought in mind that we have endeavored to outline briefly a number of the practices already placed in effect.

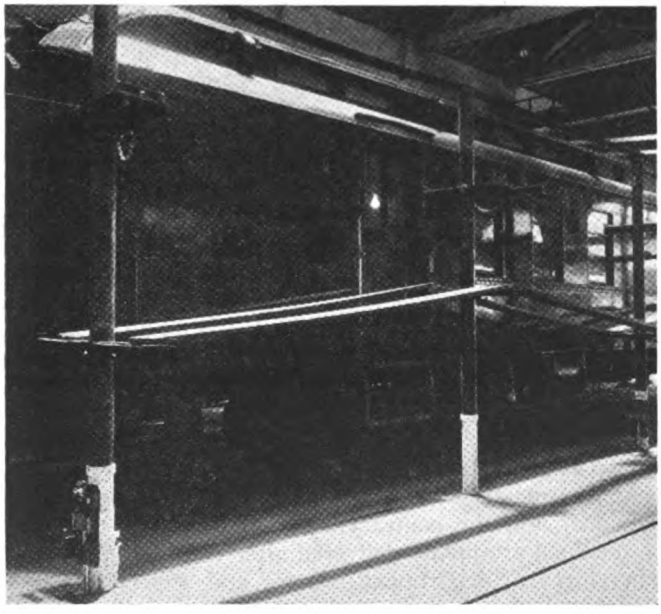
Thirty-Six Suggestions for Saving Manpower or Materials

1—Portable car washing machines which can be used on certain types of equipment are electrically operated and inexpensive to install, being introduced to conserve both labor and material. This machine with rotary brush action operates on a set of rails installed across

a series of train-yard servicing tracks at a designated location, preferably at a point where trains enter the yard from lead tracks. As a train is about to enter a yard on some specific track, the car washing machine is pushed across to the location and washes both sides of the exterior of equipment as it moves through at a moderate rate of speed. If desired, water can be trapped, cleaned and re-used. The machine, operated by two men, one on either side, eliminates the present large number of two- and three-men wash gangs as well as conserving car wash brushes and water hose, both materials being more or less difficult to obtain.

2—Fork lift trucks, capable of lifting 6,000 lb. are being used quite extensively, particularly around shops, for the transportation of mounted wheels to and from wheel shops, storage tracks and drop pits. At one particular point this type of truck is also being utilized for the removal and application of Waukesha engines to passenger equipment.

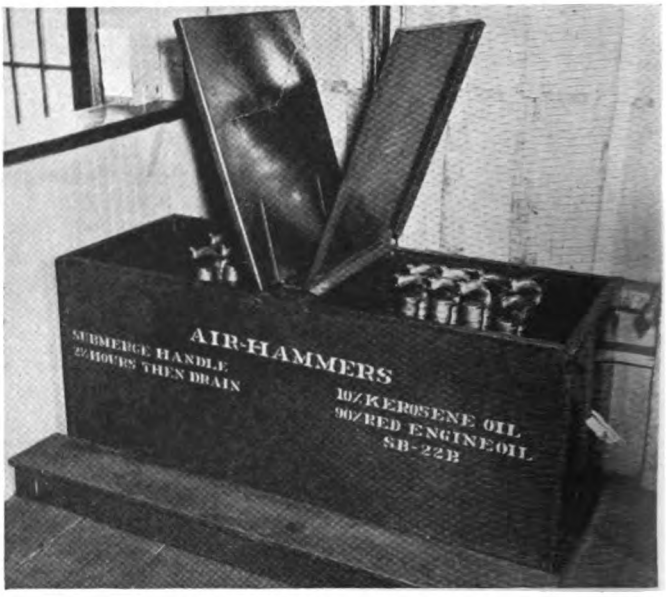
3—Car-wheel grinders are being used to grind all steel wheels and effect a substantial increase in the total wheel mileage. Extensive study has definitely disclosed that the wheels that have been ground ran far smoother and reduced to a minimum the oscillating movement of the car body, thus preventing to a great extent wear on the superstructure, truck parts such as brake hangers, hanger pins, brakebeams, brakeheads as well as bearings, axles and wheels. It will also tend to reduce hot boxes from waste grabs or broken bearings which occur as the result of the action of an eccentric wheel, particularly on high-speed trains. Tests made of the riding qualities of high-speed passenger equipment has proved conclusively the necessity for concntric wheels. The



Adjustable scaffolding in coach shop with convenient electric outlets on vertical posts

grinding machine effects savings by increasing total mileage between the turning and grinding operations. It will reduce the loss of service metal as compared to the present practice for the reason that the wheel-lathe tool must cut approximately $\frac{1}{16}$ in. under the hard surface of the wheel treads. It has been estimated that, with the grinding operation, the life of wheels can be increased at least 25 per cent. In the instances where wheels are tread-worn-hollow the flanges and the shoulders on rim are ground down with practically no loss of service metal from treads. Wheels with flat spots ranging up to 2 in. are all ground.

4—Car pullers are becoming more and more useful as time savers for moving cars in shops and in train-yard repair-track buildings. There are many types of car pullers available and in use, some of which have been designed and built in railroad shops. At one location, a portable car puller is used for spotting of streamliner



Immersion tank used in lubricating air hammers

trains over available pits for wheel changes, etc., thus eliminating the need of motive power for this purpose. This car puller is anchored to a steel ring recessed in a concrete rampway and in using a 1-in. cable this 10-hp. car puller will move a total of 18 units in one train.

5—There is very little to say concerning the motorized tractor as this class of equipment is almost indispensable for the work of handling material on skids or platforms, hauling trailer equipment loaded with usable or scrap materials, propane tanks, ice and rubbish. The various types of tractors and trailer equipment are finding more uses every day in order to conserve man power.

6—Narrow-gauge or industrial tracks are being used around wheel shops, repair-track shops and storage tracks in order to facilitate handling and to conserve man power that was formerly involved in handling wheels with wheel sticks. Abolishing the use of wheel sticks in order to prevent damage to journals is a matter that is being encouraged constantly by the wheel committees.

7—Overhead cranes as well as monorails with chain hoists are being used in the various shops for the handling of heavy materials and thereby conserving labor and speeding up production.

8—The use of adjustable scaffolding in passenger-car shops is steadily increasing in order to facilitate work and conserve labor. Vertical posts are equipped with electrical outlets for use in plugging in electrical appliances, extension cords, lights, etc.

9—Immersion tanks are being used quite generally for the lubrication of riveting hammers. Handles of hammers are submerged in a mixture of 10 per cent kerosene and 90 per cent engine oil after which they are placed in a vertical position in a perforated rack and allowed to drain. This arrangement has reduced the maintenance cost of air hammers.

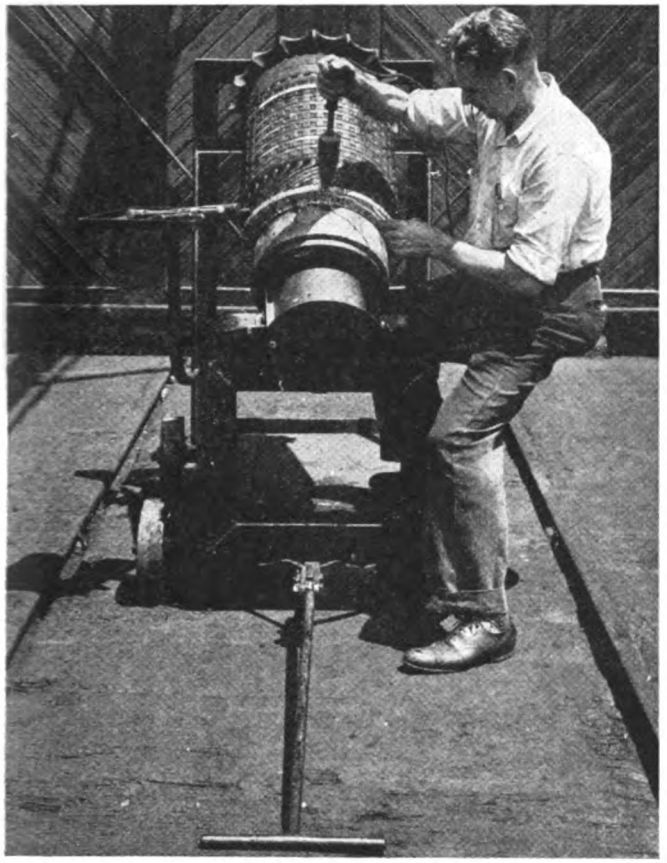
10—A jig is being used to assist in the soldering of

commutators on armatures. It is designed to hold armature for soldering at the correct degree so that solder will puddle at the desired point. Ends of the armature are supported on bearings so that it can be rotated and jig is mounted on wheels for movement about the shop. This method has resulted in substantial savings in labor.

11—Installations of 15-kva spot welder for sheet-metal work on passenger cars has facilitated production in sheet-metal shops.

12—Flexible jigs for welding are being used extensively to position work and increase production. To all metal castings found worn or defective consideration is given as to the salvaging possibilities by welding processes and subsequent treatment.

13—On passenger cars riveted sides, ends and roofs



Jig used in soldering the commutator leads of electric motors

that are worn or rusted through have been replaced in part or whole by welded sections with completely satisfactory results. Vestibule and baggage-car side doors, ventilators, inside trim and many other parts have likewise been profitably subjected to welding.

14—Sheet steel is being substituted for aluminum alloy in repairs to lightweight cars when renewing full sections of skirt sheet. Likewise, body end closing sheets are spliced by using sheet steel, employing a sheet-steel batten (secured with tap screws) over the joint of the dissimilar metals. Aluminum alloy removed and salvagable is cut up in sections and used for patching on this same class of lightweight equipment.

15—Aluminum sash and framing for air-conditioned cars cannot be obtained and one railroad has developed what we believe to be an excellent substitute incorporating the use of double wood sash. The outside sash is secured and sealed to exterior sheets while the interior sash swings on a piano type hinge and is held in closed position with a locking arrangement which is released by a small key or wrench. Dehydrators will operate successfully with these windows.

16—Sanding machines are being used quite extensively, replacing the former practice of sanding sash, etc., by hand.

17—Paint mixers or tumblers, air and electrically operated are being used in paint shops to conserve labor.

18—Owing to the scarcity of mahogany lumber for passenger-car interior finish it has become necessary to substitute white wood for this urpose. Where renewal of mahogany-face ply-wood ceiling panels is found necessary, it has been decided to use pressed wood panels and this practice has developed decided savings in both labor and material.

19—Ventilators on baggage cars are being reduced almost 50 per cent and the excess openings closed, thus reducing the number of ventilators to be repaired or manufactured new.

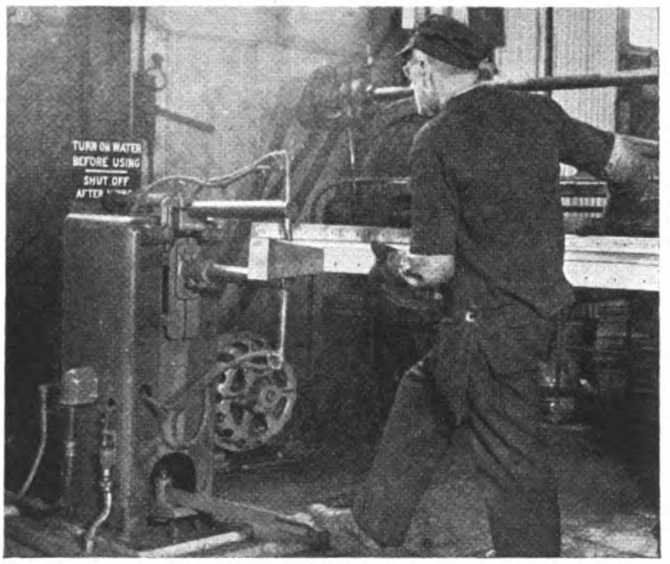
20—As the top side of side-stem brackets become worn a washer is welded to the worn surface, thereby eliminating the labor formerly involved in sending to the blacksmith shop for removal, reaming and riveting. Also, when a center-stem plate becomes worn a new one is welded instead of riveted to the buffer which saves countersinking, etc.

21—Kinds and sizes of glass are gradually being reduced, consideration being given to substituting less expensive glass for plate. Partially cracked or broken glass is being salvaged and cut into small sizes and used for repairs around buildings.

22—Due to the inability to procure such material as rubber floor tiling, linoleum and carpeting, many railroads are substituting asphalt tile for the floors, including lounge and dressing rooms. This can be obtained in various sizes and colors in order to conform with the individual interior finish of cars and is very attractive, easy to keep clean and has the desired lasting quality under the most severe traffic conditions.

23—Canvas is serving as a substitute when necessary to replace a rubber diaphragm curtain on streamliner equipment. Old sponge rubber removed from seats or used as carpet padding is being utilized for dust-seal boots in vestibules.

24—Galvanized iron has been substituted for copper in the construction of hopper tubes and the lining of way-



A spot welder which helps greatly in connection with sheet-metal work

car ice boxes. Further, in the instances where a double coil of ¾-in. o.d. copper tubing was used in hot-water heaters, one coil of ⅞-in. tubing has now been substituted and is giving satisfactory results.

25—Wood has been substituted for plastic seat caps.

26—An insulating material has been substituted for aluminum bronze for the interior painting of baggage cars, for the trainmen's lanterns in place of tinning and for all interior fixtures that were formerly sprayed with statuary bronze.

27—Welts on upholstered seats and cushions have been dispensed with due to the costly maintenance.

28—White duck has been substituted for burlap on edges of seat cushions and appears to have better lasting qualities.

29—As a substitute for canvas, blue denim material is being sprayed with a rubberized material that is fire proof and then used for engine cab curtains.

30—Felt has been substituted for sponge rubber as weather stripping on sash.

31—In the instance where rattan-covered seats and backs have edges worn, some railroads are applying a strip of Pantasote secured to the rattan with glue and underneath with tacks. This practice is said to have materially reduced the number of claims formerly received from women passengers who damaged their silk hose on the frayed and broken edges of the rattan.

32—In the conversion of parlor cars into coaches, the plush has been salvaged and used for recovering dining car chairs, powder room furniture and seat arm rests.

33—The broken parts of elliptic springs are being replaced and the springs returned to service. Coil springs with a permanent set beyond working limits are also being reclaimed. When these springs are broken the parts are heated and converted into drift pins, punches and other devices which were formerly manufactured from carbon tool steel.

34—Casings of automatic slack adjusters which have become worn are built up by welding, rebored and are returned to service.

35—Pipe, fittings and valves formerly removed from kitchen cars clogged with scale and alkali deposits and then scrapped are now dipped in muriatic acid which removes the scale and then re-used for various purposes.

36—It has been necessary to substitute hard wood for rubber on top of journal boxes to serve as insulation, substitute open-hearth steel three-piece liners for alloy-steel journal box liners and substitute open-hearth steel one-piece liners for alloy-steel pedestal liners.

Too numerous to mention are the many truck parts that are being built up when worn and then either machined or ground, whereas a certain percentage of this class of material was formerly scrapped. Owing to the importance of this class of work, most railroads are making it a practice to send samples of their welders' work to the testing laboratories periodically for analysis. With this in mind, the welders are more exact in performing either acetylene- or arc-welding work.

The report was submitted by C. P. Nelson, chairman, car shop superintendent, C. & N. W.

Report of Committee on Loading Rules



E. N. Myers,
Chairman

Recommendations are made for revisions to four general rules and four figures

Committee No. 8 on Loading Rules has given consideration to all suggestions received during the year, and those which were concurred in are included in the following recommendations for changes in the existing rules. It will be noted that only one recommendation was made for addition to the loading rules, it being our thought that with more intensive supervision at shippers' plants and at loading points, in an effort to have shippers comply with the existing rules, much of the difficulty now being experienced would be minimized and in most cases eliminated.

We believe that if all concerned will put forth every effort to furnish shippers with advice and instruction, to the end that full compliance with the loading rules will be met, a considerable reduction can be made in the number of loads shopped for adjustment.

General Rules

Rule 7—Revision is recommended to indicate that the rule applies to single loads only. *Reason.*—Loads other than single loads are provided for in Tables 1 to 35 inclusive.

Rule 10—Provide maximum height of stakes above cross ties. *Reason.*—To reduce clearance dimensions.

Rule 13—Maximum length of steel slide plate, Rule 13, should be confined to length equal to width of car. *Reason.*—Steel sliding piece should have some support and not extend beyond sliding piece.

Rule 15—Revision of the third par., sec. (b), Rule 15, is recommended to provide for 2-in. band as substitute for the metal filler specified. *Reason.*—Experience has shown that a 2-in. band provides adequate protection.

Figures

Fig. 120—It is recommended that definite specifications be provided in Fig. 120.

Fig. 208-209-209A—It is recommended that revision of Fig. 208-209-209A be made to provide for side and end blocking in addition to anti-skid plates. *Reason.*—Due to number of shipments shopped for blocking where blocking and anti-skid plates were not used.

Fig. 208-209-209B—It is recommended that headings be limited to three tiers and that a weight limitation be put on the pile. *Reason.*—To avoid boxes collapsing.

It is recommended that the committee provide a stake-pocket protector for cable when used. *Reason.*—Experience has shown that protectors are absolutely necessary.

It is recommended that specifications be provided for loading ingots diagonally with car. *Reason.*—To overcome concentrated loads and provide a method not now covered.

It it recommended that rules and figures be reviewed and definite means be provided for securing blocking with nails and bolts where not now shown.

The report was submitted by E. N. Myers (chairman), chief interchange inspector, Twin City Joint Car Inspection Association, St. Paul, Minn.

[This report has been approved by the C. D. O. A. Executive Committee and ordered submitted to the Association of American Railroads for consideration by the Loading Rules Committee.—EDITOR.]

Job Training—Proper Utilization of Manpower



J. E. Keegan,
Chairman

More women must be employed—Specialized job training for new employees

The railroads are today faced with a serious problem—that of filling jobs vacated by employees who have joined the armed forces and of filling additional jobs made necessary by the increased demands now being made on the railroads. The car departments on the railroads have their share of this problem. It has, therefore, become necessary for car department officers to fill many of these jobs with employees having little or no mechanical training as well as with employees who have had no previous railroad experience. Hence, the subject of Job Training and Proper Utilization of Manpower is one which has an important bearing on freight- and passenger-car maintenance, the topic formally assigned to Committee No. 2 for consideration.

Increased employment of women is necessary. This is being done by many railroads with marked success. A few of the jobs in which they are now being employed are upholsterers, machine operators, crane operators, turntable operators, machinist helpers, carman helpers, electrician helpers, car oilers, stores attendants, passenger-car cleaners and messengers. It is generally found that they are interested in their work and if properly trained, are doing their share toward the successful operation of the railroads and the successful outcome of the war. In questioning women applicants it is often found that they are enlisting in railroad service as a patriotic duty, having husbands, brothers or sons in the armed forces who were formerly employed with the railroad. Such women employees, if physically and mentally fit, prove to be valuable additions to the ranks of railroad workers.

Owing to the present emergency, it becomes necessary to train employees in as short a time as possible. On account of this situation, it cannot be expected to create mechanics, as we know them in normal times. It is therefore advisable to train employees to specialize in certain mechanical jobs. The first essential is the proper selection of the trainee. Careful selection of applicants, based on their qualification, will result in more satisfactory and satisfied employees. Earnest desire and ambition on the part of the trainees is of prime importance if these jobs are to be successfully filled.

The proper training of employees is the duty of supervisory personnel. The new employees must be taught to do their jobs correctly, quickly and safely. The training period must necessarily be as short as possible. The principle of the Training Within Industry plan developed by the Federal Commission has been adopted by various railroads and is proving successful in training employees in a remarkably short time. Under this method classes in job instruction are held which are attended by the supervisor. These classes are conducted by a trainer who teaches the class a quick sure method of instructing new employees. The employee must first be told how to do the job, then shown. This must be repeated until the instructor is satisfied that the learner is ready to attempt the job. The learner must then demonstrate to the supervisor that he is able to perform the job in a satisfactory manner. The practice of assigning a new employee to an experienced employee for a period of time and then expecting him to do the job successfully must be forgotten.

Specialized Job Training Is Essential

As stated earlier, there is not time to develop employees into full-fledged mechanics. It, therefore, becomes necessary to train them to perform a certain definite job in a satisfactory manner. The employee thus becomes an expert on that particular job and he should be employed on that particular job instead of being continually transferred to jobs with which he is not familiar.

Because of the shortage of manpower it is necessary to retain all present employees to the greatest extent possible. It may be that the first job to which an employee is assigned is one for which he is not fitted and to which he cannot adapt himself. When this condition arises the employee, if possible, should be given an opportunity to try other jobs until one is found which the supervisor feels can be handled by the employee satisfactorily, at which time the thorough training should be given. It is important that every effort be made to

prevent a large turnover in forces. Every new employee requires a training period, which lowers efficiency and output. Working conditions should be given full consideration and should be maintained on as high a level as possible. The handling of questions, objections and grievances should be judiciously done. Suggestions for the betterment of conditions, improved methods of performing jobs and development of better procedures should be encouraged. Enthusiasm among employees should be encouraged and maintained.

Importance of Conserving Manpower

Waste of manpower must be avoided. It is the duty of the car-department supervisor to know that manpower is not being wasted by the use of more employees on a job than are necessary for the satisfactory completion of that job. Careful study of the job is necessary to accomplish this.

The question of safety should be given as much consideration as the mechanical training of employees. Because new employees of today are generally totally inexperienced in conditions found on railroads, the man hours lost due to accidents has increased alarmingly. The employees must first be taught the importance of proper dress. They must be impressed with the necessity of performing their duties in a manner that will be safe for them and for their fellow employees. On some railroads the gang supervisors or gang foremen hold daily meetings in the morning prior to starting time of their shops at which time the question of safety is discussed and impressed on the employees.

These are but a few of the many problems concerning the car department officers of the American railroads and which they must solve as their part in winning World War 2.

The report was submitted by the chairman, J. E. Keegan, chief car inspector, Pennsylvania.

Report on Car Interchange and Billing



E. G. Bishop,
Chairman

Rule 9

The committee recommends an additional sentence be added to Rule 9, A. A. R. Code of Rules, Page 38, Use of Billing Repair Cards, Air hose, applied.

Proposed Form: New or second-hand, or spliced per A. A. R. Specifications. *Letters S. P. S. may be used to indicate spliced per A. A. R. Specifications.* Cause of removal. Item number as outlined in Rule 56 may be used to indicate cause of removal.

Reason: To eliminate writing on billing repair cards.

Rule 16

The committee recommends that Par. 4, Rule 16, be changed as follows:

Proposed Form: A road having in its possession an empty tank car due for the test of *tank or* safety valves *or both* must make such tests in accordance with the I. C. C. Regulations (*Set Interpretations 1 and 2 of Rule 3*) billing the owner for the cost of same. *Such tests may be made* within thirty days in advance of expiration of the time limit for such test or on account of illegible stenciling.

Reason: Testing of tanks should be handled in same manner as safety valves, as it relates to expiration periods. (Reference to Rule 3 Interpretations 1 and 2 added for convenience.)

Rule 17

The committee recommends change in answer to Interpretation (M-9), Rule 17.

Proposed Form: Q. Does the substitution of a rolled steel channel or heavier pressed steel spring plank in place of a pressed steel spring plank, constitute wrong repairs?

A. No, providing spring plank applied has sufficient clearance for truck bolster and otherwise conforms to standard of car. Charge and credit should be on basis of material applied and removed, *however, the substitution of pressed steel spring channel, when rolled steel channel is standard to car, is wrong repairs, and defect card must be issued for labor and material.*

Reason: Not generally understood that such wrong repairs weakens the structure of car, and is therefore considered as wrong repairs.

Rule 18

The committee recommends Par. (b) (2) Rule 18 be amended.

Proposed Form: (2) In the application of second-hand or reconditioned coupler bodies or complete coupler, the shank shall be not less than 21 in. in length from striking horn to crest of worn surface of butt, nor less than 3⅞ in. from pulling (rear) surface of horizontal key slot to crest of worn surface of butt, established with parallel straight edges (see Fig. E), *the shank wear, due to contact with the carrier, must not be in excess of — inch.* Coupler bodies having such minimum dimensions shall not be removed from cars for these defects alone, but if removed for other reasons and otherwise serviceable same shall be credited at *scrap* value.

Reason: To insure the application of suitable couplers, so far as concerns shank wear, warranting second-hand price being charged. This limit to be established by the A. A. R. coupler committee. Establish scrap credit, instead of second-hand, as a matter of equity, so that repairing line may recover expense of reclamation.

The committee recommends Par. (b) (3) Rule 18 be amended.

Proposed Form: Coupler bodies having cracks within he shaded area shown in Fig. D must have the cracks velded when applied to foreign cars. Coupler bodies having cracks within the shaded area shall not be removed from cars for this defect alone, but if removed for other reason and if otherwise in serviceable condition same shall be credited ——— value.

Reason: Reference in the present Rule to note (c-l-b) s erroneous, as the note has been removed. Change in credit allowance recommended in order to set an equitable price for reclamation.

The committee recommends that a new paragraph be inserted in Sec. (c) Rule 18.

Proposed Form: Recommend new paragraph be inserted in Sec. (c), specifying limits for removal of coupler bodies from service for the defects mentioned in Par. (b) (2).

Reason: To remove from service coupler which may be dangerous.

Rule 23

The committee recommends "Coupler Yokes" be inserted in Par. 7, Sec. A, Rule 23.

Proposed Form: 7. Marking Welds.—When truck side frames, bolsters, *coupler yokes,* or knuckle side wall of coupler heads are welded, a record must be stamped by at least ⅜-in. steel stencils on the weld or immediately adjacent thereto to indicate railroad reporting marks, date, shop identifying symbol and welders identification number or mark, arranged in the following form: Reporting marks, A B C 10-31-41. Date; shop identifying symbol, AV 72. Welder's mark.

Reason: To conform with Rule 23 Par. (gi-9).

Rule 32

The committee recommends the word "body" be inserted in Par. (10) (f) Rule 32.

Proposed Form: (10) (f) Pushing car *body* over bumping post or other obstruction, or striking overhead fixed obstruction.

Reason: Clarify what is believed to be the intent of the rule.

Rule 98

The committee recommends note be added to Sec. (i) Rule 98.

Proposed Form: Add note to section (i) Rule 98 reading, "One-wear wrought steel wheels removed for vertical, thin, or high flange are not subject to reclamation unless the total tread thickness is at least 1 1/16 in. before turning."

Reason: For information of railroads not acquainted with this reclamation, it being our information that the Wheel Committee in conducting a study has found that unless there is at least 1 1/16 in. total tread thickness before turning that it is impossible to turn them and keep them within the minimum dimensions.

The committee recommends the following questions and answers be added to Interpretations (i) Rule 98.

Q. In the event of one 1-wear wrought-steel wheel having vertical, thin, or high flange, and total tread thickness less than 1 1/16 in. before turning and the mate wheel condemned by remount gage, but having total tread thickness of at least 1 1/16 in., the wheels would be dismounted and the latter wheel set aside for reclamation by turning. How should this reclaimable wheel be credited when removed from car inasmuch as its actual turning has to be deferred until suitable mate wheel can be obtained?

A. In such case, the reclaimable wheel referred to may be credited on basis of having 2/16 in. of service metal after turning as an arbitrary proposition to cover such individual cases, rather than hold up the bill until the wheel is actually turned. It must be understood, however, that such arbitrary proposition will not apply where the wheels are reclaimed without dismounting from axle.

Reason: To facilitate prompt billing, eliminating the necessity of holding the wheels at wheel shop for excessive length of time until mate wheel can be found.

Q. Where a one-wear wrought-steel wheel is condemned account vertical, thin, or high flange, but is reclaimable, and the mate wheel is not condemnable by any gage, shall the latter wheel be reclaimed by turning so as to correspond with the mate which is reclaimed by turning?

A. No. In such case the wheels shall be stripped from axles and the wheel not condemnable by any gage credited as second-hand and so reused by remating with another secondhand wheel.

Reason: To establish correct wheel shop practices, principally with the thought in mind of the conservation of critical material.

Rule 101

The committee recommends "Coupler Yokes" be added to Weights of Miscellaneous Items.

Proposed Form: Coupler yokes, wrought iron and cast steel 18½ in. and 24⅝ in. pocket.

Reason: To facilitate the preparation of billing repair cards and save labor on repair track obtaining scale weights.

Note: Weight for these types of yokes to be determined by A. A. R. Price Committee.

Form for Original Record of Repairs

The committee recommends elimination of the note at the bottom of the form entitled Association of American Railroads Original Record of Repairs (Interchange Rules, page 274).

Reason: The note, as written in its present form, is misleading inasmuch as it does not specify all information to be shown on the original record required in other rules, such as Rule 104 (1), etc.

Passenger-Car Rule 8

The Committee recommends (17) (e) be modified. P.C. Rule 8.

Proposed Form: (e) Journal cut, or requiring reconditioning due to heating, on friction bearing units; *except where lubrication device other than waste packing is used;* axles bent; or axles damaged as provided in Par. (a). When necessary to true up axles in case of cut journals, if journal is reduced below the limit as prescribed in Rule 7 (e), axle must be changed at the expense of the delivering line.

Reason: Various devices more or less in the experimental stage are being used, and it is thought that a car owner desiring to experiment shall do so at their own expense.

Index

In this committee's report for the year 1941 a partial report was made in connection with recommendations for revision of index to the A. A. R. Interchange Rules. Since that time and up to the present this matter has been actively progressed. We are now submitting our draft of complete revision of the index.*

Sec. I is the proposed revision, and Section II is the

* Not included in this abstract of the committee report on account of space limitations.

present form as outlined in the book effective January 1, 1943.

It is estimated that the proposed form will require 19 pages in the rule book. Your committee regrets that it was not possible to confine their proposal to the limit of 12 pages as recommended in their instructions.

This draft is being submitted in the hope that the Arbitration Committee of the A. A. R. Mechanical Division will be able to reconsider their decision regarding the amount of space which the index should occupy, as your committee feels that with the amount of inexperienced help which must be used both in billing offices and in the field it will be a big advantage to have this index as comprehensive as possible.

The revision of the index is almost entirely the work of D. E. Bell, A. A. R. Instructor, Canadian National, vice-chairman of this committee, and the entire Committee, recognizing the volume of work and the thoroughness of this index revision, express their appreciation to Mr. Bell and pass on to him full credit for the accomplishment.

The report was submitted by Chairman E. G. Bishop, general foreman car department, Illinois Central.

[This report has been approved by the C. D. O. A. executive committee and ordered submitted to the Mechanical Division of the Association of American Railroads for consideration by the Arbitration Committee.—EDITOR.]

Painting Freight Cars



L. A. Hartz,
Chairman

The report reviews painting procedure for the protection, inside and out, of steel cars

As most equipment is built of steel, it is only fitting that we give some thought to rust and corrosion and causes contributing to its formation on these metals. According to most accepted theory, rusting is an electrochemical process affecting most steels as they are not pure substances of perfectly uniform structure. Ordinary open-hearth steel contains small amounts of carbon, silicon, sulphur and phosphorus. These substances are in various states of combination within the metal and vary in its physical structure. Nearly all these substances are soluble in water to some extent and although the amount of solution may be very small it is readily apparent that this condition is ideal for the interplay of electrical potentials whenever water or water vapor is present. The solubility of these substances is increased if the water contains traces of gases, salts or acid. Thus iron dissolving from a paint on the surface will form ferrous hydroxide which changes to iron oxide in the presence of air. This is the familiar reddish brown substance which is called rust.

As closed-top hopper cars come to the shops for repairs, inspection is made and if cars are badly corroded they are sandblasted, both interior and exterior. The cars are then sprayed with red-lead primer, in some cases read-lead-chromate primer. Most railroads use no paint over the primer.

Prior to the war it was possible to obtain a rubber pigmented paint which stood up very well in this class of equipment.

The exterior is sprayed with an acid-resistant paint. The underframes and ends are sprayed with car cement. A car that is not badly corroded has the rust spots cleaned off with an air-driven wire brush. The spots are then spot primed and car is now ready for paint. These cars are painted every two to three years, depending on the commodity handled in them.

Open-top hopper cars are taken into the shop, stripped and sent to the sandblast. They are then sprayed with red lead or red-lead-chromate primer. The underframes are sprayed with car cement or a non-corrosive primer. After the cars have passed through the repair shops and are ready for painting, all new metal is primed with red lead or red-lead-chromate primer, over which two coats of standard specified paint are applied. Some railroads use no primer, applying two coats of gondola black paint.

One railroad has in service a number of open-top hopper cars which are being used in the hauling of sulphur only. These cars had the interior metalized with aluminum using an acetylene metalizing gun for this application. They have been in service for two years and are holding up satisfactorily. This method is not now available, because it is being used extensively to protect the bottoms of ships. Open-top hoppers are painted every two or three years, and in some cases more often on account of frozen loads being thawed with torches to make hoppers operative.

Painting the Interiors of Steel Box Cars

Steel box cars are all lined with wood sheathing with the exception of the roofs which are in most cases, galvanized iron. Over this has been sprayed an asphalt and cork moisture-repellant mixture, which has been successfully used in combating condensation so prevalent on a metal ceiling, with so many commodities carried in these cars from cold to warm climates. The cars are washed down, repaired, and a coat of varnish sprayed over sides and ends. This class of equipment carries the highest grade of commodities, such as flour, grain and other food products which must be carefully kept from becoming contaminated while in transit.

The report was submitted by L. Hartz (Chairman), foreman painter, Illinois Central.

Locomotive Maintenance Correspondence Forum



J. E. Goodwin, President



C. M. Lipscomb, Sec.-Treas.

The L. M. O. A. sponsors roundtable discussions of six timely problems —Supplemented by a study of the railway machine tool situation

THE leaders of the Locomotive Maintenance Officers' Association decided early this year that because of the pressure under which the members of that organization are working, it would hardly be advisable to attempt to carry on committee work during the current year. On the other hand; there was a pronounced feeling that never was there a time when it was more important for the members of the association to give thought and study to the many difficult problems and situations involved in attempting to keep the motive power in prime condition, with the shortage of critical materials and manpower.

Meanwhile, the rather remarkable success that has followed the Roundtable discussions inaugurated by the *Railway Mechanical Engineer* last April, suggested the idea that the equivalent of committee reports in a "Convention-in-Print" could be achieved by having the Association sponsor a series of intensive roundtables, through correspondence, of a number of questions of special interest, a solution or better understanding of which would be helpful at this time. The fine spirit in which railway mechanical officials participated in these Roundtables is a matter of deep gratification.

The editors of the *Railway Mechanical Engineer* have supplemented this with a study of the machine tool requirements on the railways, which was made possible through the generous co-operation of the railway mechanical departments.

Officers of the Association

The officers of the Locomotive Maintenance Officers' Association are: President, J. E. Goodwin, assistant chief mechanical officer, Chicago & North Western, Chicago; first vice-president, F. J. Topping, master mechanic, Chesapeake & Ohio, Hinton, W. Va.; second vice-president, S. O. Rentschler, mechanical superintendent, Southern district, Missouri Pacific, St. Louis, Mo.; third vice-president, C. D. Allen, master mechanic, Chesapeake & Ohio, Silver Grove, Ky.; and secretary-treasurer, C. M. Lipscomb, assistant to production engineer, Missouri Pacific, North Little Rock, Ark. The members of the executive committee are F. J. Topping (chairman); George Crowder, superintendent motive power, Georgia & Florida, Douglas, Ga.; W. P. Buckley, shop superintendent, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.; W. E. Vergan, supervisor air brakes, Missouri-Kan.-Tex., Denison, Tex.; G. A. Silva, supt. locomotive maintenance, Boston & Maine, Boston; and G. E. Bell, gen. for. Ill. Cen., McComb, Miss.

The association's advisory board consists of P. O.

Christy, general superintendent equipment, Illinois Central, Chicago; D. S. Ellis, vice-president, Lima Locomotive Works (formerly chief mechanical officer, Chesapeake & Ohio, Pere Marquette and Nickel Plate); O. A. Garber, chief mechanical officer, Missouri Pacific; J. Roberts, managing director, National Railways Munitions, Ltd. (formerly chief of motive power and car equipment of the Canadian National Railways); and Daniel J. Sheehan, superintendent motive power of the Chicago & Eastern Illinois.

Roundtable Discussion on Flame Hardening

Question—Have you used flame hardening on locomotive parts? Has this process helped to solve material shortage problems?

Anticipates Longer Life Of Parts Subjected to Wear

It was not until a short time ago that the Boston & Maine started to experiment with flame hardening. The first step was the construction of a machine which could adequately take care of the great variety of work naturally associated with the back shop. The machine, constructed in the shop, was built after plans supplied by the vendor, with few changes.

Up to the present time experimental work has been done on crosshead guides, radial buffers, chafing irons, stoker conveyor screws, stoker screw racks, spring saddles, motion links, lead truck rockers, gun iron shoes and wedges, valve crosshead guides, valve guide plates, valve crossheads, union link pins, driving box wearing plates and hammer dies. Plans are being made to flame harden multiple wear guides as soon as special heads are available.

Considerable work has been done on guides to determine deformation and necessary corrective heating, but as yet definite conclusions are not available. On valve crossheads it has been found most advisable to first harden the sides, which have the larger surfaces, and then the top and bottom, being careful to raise the flame while passing over the combination lever middle pin hole. By following this procedure, the hazard of cracking is greatly reduced. Some of the work has been done on material built up with Oxweld M & W steel, which seems to respond quite well to the treatment.

In working with various kinds of material it has been found that cast iron responds most favorably to flame hardening, and at the present time seems to present the most promising field.

As to the shape of the work hardened, a certain amount of trouble has been encountered with thin sections, where deformation has been quite considerable at times. On large bodies there has been almost no trouble of this kind.

Of considerable interest has been the flame hardening of No. 4 Nazel hammer dies. Dies so treated have stood up with negligible wear for a considerably longer time than the conventional die.

Aside from the work on dies, we have nothing to report on wear characteristics of work flame hardened in our shop, as the service has been too short. We are constantly changing our procedure and should soon have developed a quite satisfactory set of data from which to develop interesting conclusions. All the work enumerated above has a large bearing on the saving of material. We are anticipating long life of flame hardened parts.—*W. H. Ohnesorge, Shop Superintendent, Boston & Maine, North Billerica, Mass.*

Results Demonstrated

We are working on and making up a flame hardening set-up for our smith shop. We expect to have it completed and installed shortly.

However, we had a demonstration within the past year by the Oxweld Railroad Service Company, at which time we flame hardened the following: Steam hammer die block, top and bottom guides, two stoker screws, stoker pinion gear, stoker gear, spur gear, spring saddle, rocker seats for engine truck, and valve crosshead.

I believe that steels that contain at least 0.35 per cent carbon and over can be successfully flame hardened. After all, flame hardening is only surface hardening and the surface to be treated must be free from seams and laps, pits and blow holes. If we hold our flame hardening to machined steel parts, such as links, link blocks, wrist pins, knuckle pins, valve crossheads, engine truck rocker guides, guides, cradle hangers, gears, etc., I feel that longer wear resulting in less frequent renewals of parts will be obtained.—*E. A. Koschinske, Superintendent of Shops, D. L. & W.*

Used Extensively on T. & P.

We have had flame hardening equipment in use at our shops at Marshall, Tex., for several years. We are continually making

Operations Using Oxweld Flame Hardening, Texas & Pacific

Operation	Brief Description	Remarks
Harden top and bottom engine truck and trailer rocker seats	Machine to undercut seats, build up with ¼ inch "MW" steel and harden to 500-575 Brinell	Originally necessary to renew on heavy power each shopping. Engines returning to shops with flame hardened seats in good condition
Harden wearing surface of passenger car truck bolster wear plates	Cut spring steel 6 inch x 8 inch and harden one side to 550-600 Brinell	Wear plates of flame hardened material on cars returning to shop are in good condition. Originally necessary to renew each shopping
Passenger car center plate wear liner	Cut boiler plate ring on shape cutting machine. Specially treat by packing in box of Quicklite case hardening compound and heat 5 hr. at 1600 deg. F. Remove from furnace and let cool in box before removing. Flame harden to 500-550 Brinell and grind to smooth surface.	Rings now under test made in this manner. Original steel rings galled
Flame hardened knuckle pins and case hardened bushings	Knuckle pin flame hardened to 500-550 Brinell. Bushing pack hardened	Knuckle pins and bushings now under test on several engines. Reports indicate satisfactory performance
Driving box hardened steel hub liner on wheel center	.45 to .50 carbon steel liners flame hardened to 500 Brinell	Several engine sets applied with good results
Hardening of teeth in ratchet track jacks	Build up teeth with Oxweld "MW" steel and harden to 650 Brinell	Previously built up lip with "MW" steel and not hardened
Manufacture of hardened flue rumbler bands	Flame hardened band for use in removing scale from flues	Originally purchased from manufacturer. Necessary to replace every few months. Flame hardened bands now in service 2 years
Manufacture of gear for pile driver	Scrap axle steel flame cut out on flame cutting machine and teeth flame hardened	Several gears in service giving satisfactory service. One such gear bought new cost $195 from manufacturer. Cost of gear as made was $21.00
Flame hardened links for test of roller bearing link block	Flame harden link block bearing surfaces	Test now being conducted
Flame hardening of valve crossheads and crosshead guides	Cross heads and guides flame hardened to 500-550 Brinell	Several engines now equipped with good results
Flame hardening of guides	Flame hardening wearing surfaces of main crosshead guides	Standard practice. Results satisfactory

use of this machine on locomotive and car parts, as well as on parts of work equipment. We have found the practice of flame hardening parts materially increases the life of the part, decreases maintenance cost, and also assists in solving the shortage of material problem. Accompanying this is a list of a number of typical items on which we have secured very satisfactory results.—*J. J. Prendergast, Mechanical Superintendent, Texas & Pacific.*

Wear is Reduced On Critical Parts

Flame hardening is the name given to a heat treating process which hardens the surface of metal to a depth of 1/16 inch to 1/8 inch. The center, or core, of the piece is not altered in any way.

The fundamental principles of flame hardening do not differ in any way from any other method of hardening. The first and most essential requisite for any hardening process is the chemical composition of the metal to be hardened and this may be expressed as the "hardenability" of the metal.

We have applied flame hardening to sections of parts requiring surface hardness and a tough, ductile core; such parts as gear teeth, engine truck rockers and seats, trailing trucks and seats can be successfully flame hardened on the wearing surface provided the carbon content of the steel is in the vicinity of 0.35 per cent. This carbon element is the principal hardening element in steels and in the plain carbon steels the carbon content must be 0.25 per cent or above, before any appreciable hardenability can be obtained. Alloys may be added to increase the hardenability of the steel and these alloying elements may be added individually or in combinations of two or more. The most commonly known alloying elements used to increase the hardenability of steel are chromium, manganese, tungsten, vanadium and molybdenum. Nickel and silicon will increase the hardenability to some extent but they are principally toughening elements.

In flame hardening, the carbon content of the steels as a whole must be sufficiently high to harden; a low carbon steel cannot be hardened by flame hardening. Also, in flame hardening as in any other method of hardening, severe stresses are set up by the rapid quench, and these stresses are often sufficient to cause warpage. When heat is applied rapidly, thermal checks will result; these checks often progress and cause failures, and all of this must be given close consideration in the selection of parts for flame hardening.

We have in the past and are now applying flame hardening to such items as driving box saddles, engine truck rockers and seats, trailing truck rockers and seats, as these are the only items for which we have jigs and suitable tips at this time.

However, even these few items to which we are now able to apply flame hardening have effected a considerable saving of critical material for us, in that it has reduced the wear on these critical parts.—*S. O. Rentschler, Mechanical Superintendent, Missouri Pacific.*

Alleviates Material Shortage

We are now flame hardening the following locomotive and car material with good results: Guides; wearing parts on engine trucks; tender equalizers for 4-8-4 type (Class T), 2-10-2 type (Class R) and 4-6-2 type (Class K) locomotives; chafing castings between tender and engine; stoker conveyor worms and spring saddles. It is felt that this flame hardening has contributed to some extent in alleviating the material shortage.—*A. H. Mitchell, Superintendent Shops, Lehigh Valley, Sayre, Pa.*

Roundtable Discussion on Engine Terminals

Question—Has any improvement been made in reducing the turning time of locomotives in your terminal in recent years? What facilities or methods have been responsible for this improvement?

Speeding Up Operations

For a number of years, a campaign has been carried on to reduce locomotive terminal time at all major terminals of the New York Central, to keep the power in actual road service as much of the time as possible and reduce the number of units in service to a minimum. This program served as a training period prior to the emergency, and has proved invaluable in handling the present business.

Formerly, the terminal facilities were thought adequate to handle the power rapidly. However, with nearly double the number of dispatchments, it is recognized that some changes, such as additional cinder pits and trackage in terminal territory, could be made which would speed up the handling of this extra load. Due to material and man power shortages, these improvements are out of the question at this time, and the situation must be met by taking up all the slack and speeding up the maintaining procedure.

Locomotives arriving on the coal dock are looked over immediately by the machinery and air brake inspectors, who phone their report to the work report clerk. The incoming engineer is required to make his report immediately on arrival. Thus the work report is completed as soon as possible, in order that the dispatching foreman may have this information well in advance of the locomotive coming into the house, thus giving him time to line up his forces for the necessary repairs and servicing. He can also give an early estimate as to the time the locomotive will be available for service.

A hostler, stationed at the coal dock, assists the inspectors in testing for pounds, steam leaks, etc., and when inspection is completed, he supplies the locomotive with sand, coal and water and delivers it to the cinder pit.

All fires are dumped on main line power to permit inspection of flues and firebox, as normally locomotives dispatched run from two to six divisions before entering another terminal. The boiler inspectors or hot men enter the firebox as soon as the fire is dumped, make a close inspection and take care of any minor repairs necessary, including cleaning off the flue sheet, hooking out flues that may contain clinkers, and making repairs to the arch.

The success of this program depends on the ability of the dispatching foreman to plan his work and instruct his forces so that his plans are carried out smoothly and all the slack is taken up as the locomotive progresses from one operation to another from coal dock to ready track. A well balanced, thoroughly instructed terminal force under an alert, capable foreman who knows what he wants and understands how to make his wants known to his men, produces surprising results. An average terminal time of four to five hours per locomotive during a twenty-four hour period is not uncommon. This average includes washouts, flue blowing and any other work requiring more than twenty-four hours to complete, so in many cases locomotives leave the ready track in one and one-half to two hours after their arrival.

Another highly contributing factor in reducing terminal time is the amount of work performed at monthly and quarterly inspections. A policy of close inspection and extensive repair at the time locomotives are cut out at these periods puts them in condition to run through the intervening time with very little attention of a time consuming nature.—*R. F. Batchman, Asst. General Foreman, New York Central, Toledo, Ohio.*

"A Stitch in Time Saves Nine"

There are several items that enter into the turning of engines at terminals, such as the program of quarterly tests for rods, pistons, crossheads, valves, etc., which parts are removed and sent to the main shops, where they are Magnua-fluxed and worn parts replaced. Stokers, drawbars, injectors, boiler checks, etc., are cleaned, inspected, and the necessary work performed. Engines are serviced not at the time of despatch, but when they arrive from the cinder pit. Washing of super-

heater units has reduced the maintenance, in that the sludge build-up in the units is removed at the time of each washout period. With the power in good condition, under the above program, it is now possible to turn an engine in 30 minutes by cleaning the fire and servicing the engine on the despatch track.—*Foreman.*

Factors That Have Demonstrated Their Value

There has been the greatest improvement made in reducing the turning time of locomotives in this terminal in recent years, due to the application of roller bearings on freight and passenger engines, locomotive and tender.

The force feed lubricator, as applied to Missouri Pacific engines—both passenger and freight—has been another important factor in reducing the turning time of locomotives and allowing us to get more miles in the aggregate per month. Also there must be taken into consideration the reduction in the roundhouse running repairs brought about by proper force feed lubrication.

New power, with complete roller bearing applications, is also equipped with the 4-in. superheater tubes where type E units have been used; this is one of the greatest improvements that could be made to a locomotive. The change from 3½-in. to 4-in. tubes makes possible several round trips between St. Louis and Kansas City in fast freight or passenger service, without boring flues.

Another factor of prime importance, which has been responsible for cutting down the time the locomotives are held out of service in the engine house, is the provision of adequate drop pits.

The Lidgerwood as used and properly handled in the turning of tires, with a competent man in charge of the work, has reduced the time out of service of our passenger and freight locomotives.—*Joseph M. Whalen, Master Mechanic, Missouri Pacific, St. Louis, Mo.*

Roundtable Discussion on Finishing Cylinders

Question—Which is better—boring, grinding or honing—such parts as air brake pumps, feedwater heater pump cylinders, reverse gear cylinders, etc.? Why?

Is Honing Necessary?

Honing is a super finish for grinding, but is it necessary? Grinding gives an excellent finish and leaves microscopic areas for the oils to cling to. Our pumps under normal operating conditions run their mileage and are in good condition when dismantled. Ring wear is very slight, which proves they must be moving over a smooth surface.—*Machine Shop Foreman.*

Grinding, Accurate and Smooth

We are grinding our air brake pumps and feedwater pump cylinders, as well as our reverse gear cylinders, and we feel this is more accurate and a much smoother finish than the boring.

We do not have a honing machine of sufficient capacity to do this same class of work, but personally I feel the honing is one step further in the perfection of the work performed.—*Bernard Cook, General Foreman, N. & W., Roanoke, Va.*

Favors the Boring Process

Although we grind such parts as air pump cylinders, feedwater heater cylinders, reverse gear cylinders, etc., in some of our shops at present, I am advocating the following practice which we have tried out and found entirely satisfactory.

On compound air pumps we place the pump cylinder attached to the center casting on a revolving table on a horizontal boring mill, and use a double spindle boring bar which is geared to drive both spindles at the same time at the correct speeds for the large and small cylinders and pilot the bar through the stuffing boxes; if these are out of line, we true them up. The pump is set true with the proof lines on the cylinders at both ends by checking with the spindle at the front end and the back end with the outer support. The cylinders next to the spindle are bored first. The table is then revolved and set true with the bored cylinder from the outer support by using a plug in the outer support bearing, to which an indicator is attached. After this is done the table is locked and the other cylinders are bored. We then lap all four cylinders with an expansion lap. This method is faster than grinding and we have increased the mileage on our pumps, as compared with other methods. The finish obtained in the cylinders by this method is equal to, if not better than grinding.

The lapping is done on the horizontal boring mill by the use of a shop-made expansion lap, which automatically centers itself and gives us a perfectly round hole and parallel full length of bore.

The same method can be used on the other type of equipment referred to.

The reason for this method being an improvement is that stock necessary to remove is taken out faster than grinding and although a boring tool can be used on a Micro grinder, it is a slow operation as compared with using a horizontal boring mill, where you have the necessary power and feeds. Carboloy is used to further speed up the boring operation.—*J. I. Stewart, Supervisor of Shop Machinery and Tools, N. Y. C.*

Manufacturer Prefers Boring

It is our experience that boring is the preferable process in finishing the cylinders of air brake pumps for the following reasons:

We, as manufacturers, must start with a rough casting and this, of course, requires boring, initially, irrespective of the finishing process. By the boring of parallel cylinders simultaneously, the matter of holding to center tolerances and alinement is simplified from that which would obtain, should grinding one cylinder at a time be practiced. Railways, when maintaining these units, have the center spacing set for them, that having been determined by the manufacturer, and their only interest is in truing up the diameter. They can, then, grind or hone where it would not be feasible for us to do so. We have no difficulty in holding to the limits of plus five thousandths and minus zero, and the surface finish which we obtain is giving satisfaction. Therefore, we feel that to change from the boring process would be economically unjustified.—*L. K. Sillcox, 1st Vice-President, The New York Air Brake Company.*

The Smoother, the Better

Honing, grinding and boring, in that order, in our opinion, are the best methods of finishing bores of cylinders on reverse gears, feedwater heater pumps and air compressors.

Basically, to reduce wear it is necessary to maintain an oil film between the surfaces in contact. An oil film can be maintained most effectively on a smooth finished cylinder bore. An evidence of the value of smooth finishing has been demonstrated by results obtained from "super-finishing". The smoother and better finished cylinder will prolong the life of the piston packing.—*K. D. Read, Asst. Supt. Locomotive Shop, N. Y. C., Beech Grove, Ind.*

Considers Grinding Best

We consider the grinding of air brake pumps, feedwater heater pumps, cylinders, reverse gear cylinders, etc., superior to boring, for the following reasons:

1—The frequency of dismantling air cylinders and center pieces on air compressors is very much less than the dismantling when the boring bar is used.

2—Less material taken out of the cylinders at the repair periods, due to the finer adjustment of the grinding wheel.

3—No trouble to fit pistons and rings, due to the fact that ground cylinders are perfectly parallel, resulting in increased life of air compressor between shopping periods.

4—Increased output of pressure has been proved by average orifice tests which have been made on air compressor test racks.

5—Less time is taken in testing air compressor. At times it is necessary, after fitting pistons and rings closely to a bored cylinder, to run the pump six or eight hours. For ground cylinders, closely fitted pistons and rings, one-half to one hour is all the time necessary for running in an air compressor with ground cylinders. This also concerns feedwater heater pumps.

It is very necessary to maintain cylinders of the reverse gear to as close a limit of 10 in. as possible, to take care of a standard 10-in. packing cup. This can only be accomplished by the grinding method.—*A. H. Williams, General Supvr. Apprentice Training, Canadian National.*

Roundtable Discussion on Welding and Cutting

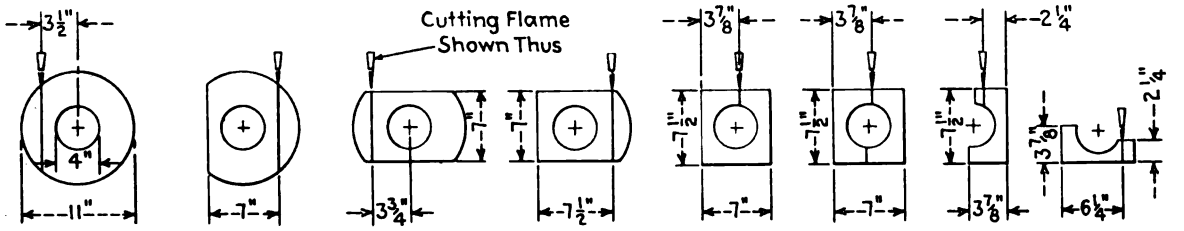
Question—What new applications of welding and cutting have you developed to meet the lack of materials and replacement parts? For instance, on driving boxes, crossheads, brackets and to replace various small forgings and castings?

Welding Proves Profitable

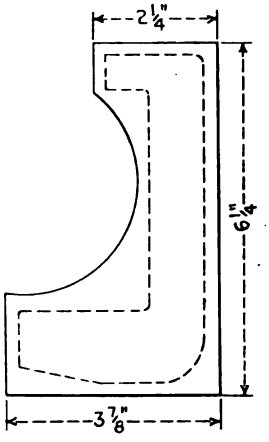
The wartime emergency has caused unusual demands for certain materials, making them critical items. In order to meet the need for replacement parts it has been necessary, due to lack of materials, to fabricate locomotive parts.

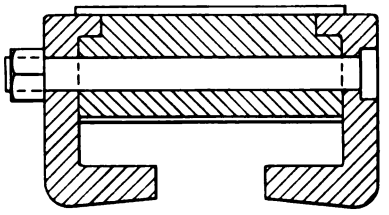
Brackets of all descriptions are now fabricated by cutting, bending, and fitting the necessary pieces of plate, which are then welded. Brackets thus fabricated invariably require less machining than the cast part and proper development of the fabricated part often results in greater strength and reduction in weight, as compared with the casting. Crosshead shoes are now fabricated from steel plate and welded construction; the weight is thus reduced to approximately one-quarter that of bronze shoes. The strength of the shoe has not been sacrificed and in the case of bronze shoes, a critical material has been released.

Fabricated parts in general have proved to be economical and practical to the extent that, in our opinion, many have taken the place of castings permanently.—*K. D. Read, Asst. Supt. Locomotive Shop, New York Central, Beech Grove, Ind.*



Sequence of operations in cutting an 11-in. diameter axle with a 4-in. bore to form the material from which the guide bar side plate is made





Section of 3 Piece Guide Bar

Left: Indicates how the finished plate is made.—Right: Cross-section of the three-piece guide bar assembly

Necessity is the Mother of Invention

Owing to the difficulty in securing materials and labor, I doubt whether any of us have been able to follow established practices in the repairing of locomotives and cars. I doubt, also, whether any of us want to go on record as to some of the practices we have been compelled to follow in order to keep our power on the road. On the other hand, many short cuts and new methods are here to stay, the same old story being still true that "Necessity is the mother of invention."

To save both labor and material, three-piece single guide bars are being made from old driving axles. The top or center section is forged from a 9½-in. axle and the sides are cut on an Oxweld cutting machine from hollow 11-in. axles. One axle makes two sides. The sketch shows the sequence of the different operations.

All railroads have more or less trouble with fixed rod bushings in side and main rods working loose in the rods, especially the cast iron and steel bushings. A good saving can be shown by metal-spraying a few thousandths of an inch on the outside of the bushing to get the required tonnage pressure. A good operator can do a job that does not require machining afterwards.

It is surprising how many parts can be fabricated with success from scrap materials, some of which will no doubt be continued after the emergency is over, such as the following: Smoke stacks out of boiler plate, valve bodies or spools out of boiler plate, pump and other brackets out of scrap material, and locomotive bells out of boiler plate.—*Shop Superintendent.*

Flame Cutting Extended

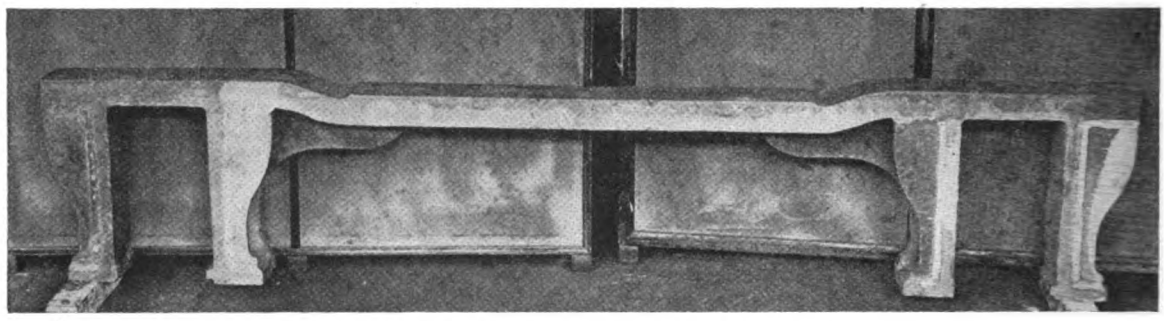
It has been our practice for some considerable time to flame cut bar stock or flame cut such items as brake beam hangers and

tender truck swing bolster hangers, and all other such parts as can be economically produced by the flame cutting process. We have found it necessary to considerably extend the flame cutting in certain parts as a substitute for castings, owing to the difficulty in obtaining castings of all kinds during the war. We do considerably more reclaiming of worn and broken parts by welding and bronzing, due to not being able to obtain any new material.—*A. H. Williams, General Supvr. Apprentice Training, Canadian National.*

Welding-Minded; Flame Cutting Also

In the locomotive department, even prior to the war, we were distinctly welding-minded. For example, when the reverse gear order was put out we found ourselves with a considerable number of different classes of locomotives coming within the scope of the law requiring reverse gears. Under ordinary circumstances, brackets for such gears would be made of cast steel, but in view of the considerable number of types of brackets required, a decision was made that all reverse gear brackets would be fabricated from steel plates and bars. Also, prior to the war we were, as a matter of standard practice, manufacturing crank beds and upper crank cases for our Model 120 Winton gasoline engines.

With this background, therefore, when the steel castings became critical, we had no hesitancy in substituting welded parts. The following are typical of some of these items: Air reservoir brackets, roller caps for Devoy trailer truck, guide yoke, reverse gear frame extension, coupler pocket for front end of steam locomotive, air pump bracket, frame filler brackets, bracket for bell stand, power reverse gear bracket, air reservoir bracket and bell crank for Baker valve gear. In the matter of substituting flame cut parts for forgings or castings, we now, as a matter of practice, cut the majority of our brake hangers, spring equalizers and the like direct from hot rolled plate of suitable composition. Such equalizers and hangers in some instances were formerly steel castings; in others, steel forgings. Flame cutting is used to a large extent in reducing machining required on almost all items of main and side rod and other motion work forgings. On one class of locomotives we were able to make a saving by cutting engine frames from rolled steel plate even though suitable patterns for cast steel were available.

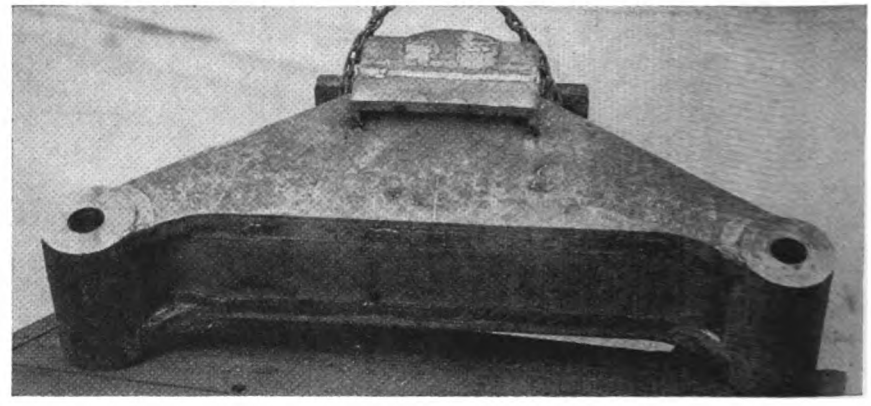


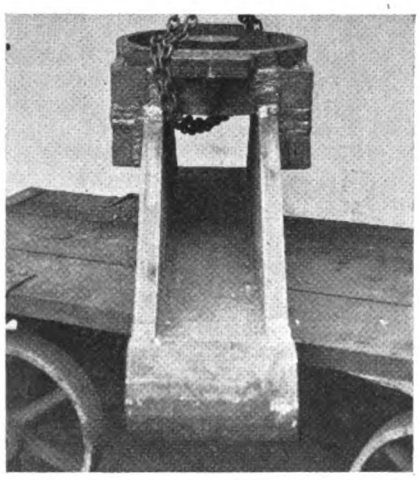
Welded side frame for Woodard engine truck, C. M. St. P. & P.

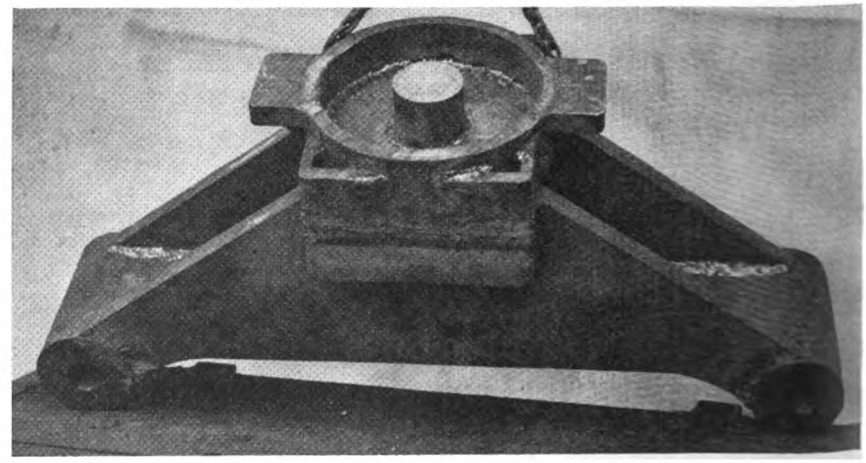
Frame sections for repairs are now all flame cut from plates. At the present time the use of cast steel locomotive frame binders has virtually been abandoned and these are all cut direct from suitable billets.

While not at liberty to disclose the details, nevertheless, as a part of our war effort we fabricated a large machine part by welding, which was formerly a casting, the rough weight of which was 29,000 lb., with entirely satisfactory results.

I might say that we have found very few







Three views of welded swing bolster for electric locomotive engine truck, C. M. St. P. & P.

items normally made in cast steel which could not be suitably reproduced by welding.—*K. F. Nystrom, Mech. Asst. to Chief Operating Officer, Chicago, Milwaukee, St. Paul & Pacific.*

Welding Locomotive Cylinders

Due to the inability of manufacturers to supply us with new main cylinders, it has been necessary to develop a procedure in welding where cylinders have dangerous fractures. After several methods had been tried we decided on the gas welding with the use of bronze welding rod. All of our cylinders are either cast grey iron or Ni-iron. Our method has proved equally successful on either, and to date we have welded main cylinders that in ordinary times we would have relegated to the scrap pile. Our procedure is as follows:

1—Sand blast the entire outside of the cylinder and determine if there are additional fractures that escaped attention.

2—Vee out all fractures, keeping the V about ¼ in. wide at the bottom and 1 in. to 1¼ in. at the top.

3—Place the cylinder in an oven and preheat with charcoal as fuel, for a period of about eight hours, to a temperature of 400 to 500 deg. F. This is usually done at night, so that we may start on the weld in the morning.

4—Once the weld is started we never stop until it is completed. We use from two to four welders, depending on the size of the weld, with the idea that the welder should not weld over 15 minutes at one time and have sufficient rest between welds, so that there will be no nervous tension if the job should take 12 to 15 hours.

Our oven is constructed as follows: The base is of circular construction, 7½ ft. in diameter, with a ½-in. by 4-in. iron band filled with firebrick, laid on the flat side and supported on suitable concrete base. Old rails are used as a support for the material to be welded, and also to anchor rollers on which the oven sets. The oven is constructed in cylindrical shape, 7 ft. in diameter, and 8 ft. high, of 3/16-in. scrap plates. Doors are cut in several places through which to weld, and are swung on hinges and latched. Two short pieces of tubing are welded to the sides of the oven opposite each other, so that a four-foot length of pipe can be inserted to turn the oven. This makes it possible to turn the doors to the weld and eliminate the uncovering of the material to be welded, thereby decreasing the danger of chilling. The top of oven is removable, as in some cases where welding is done toward the center of the material the heat will be unbearable and the top must be removed. The material is then covered to the fullest extent with sheet asbestos and the weld is made, replacing the top as soon as possible.

No. 3101 or 3500 welding rod is used with an adequate amount of flux. All welds are made in vertical position, if possible. There are several small openings in the sides of the oven, through which we can place a hand pyrometer to ascertain the temperature.

We have sometimes found it necessary, in cases where channels are fractured, to remove a piece from the saddle to reach the fracture which is welded on the inside of the channel; the piece is replaced in the saddle and welded in place.

After all the welds are completed the oven is closed and brought to a temperature of 500 deg. F. and allowed to cool down without further attention. This usually requires 48 hours, after which the cylinder is removed, the excess welding material machined off and the cylinder replaced on the locomotive. Seldom is any warping noticed.—*George E. Bennett, Shop Superintendent, C. & E. I., Danville, Ill.*

Roundtable Discussion on Training Methods

Question—Have you employed special training methods for supervisors and mechanics? What results have you obtained from these wartime measures? What features of this training do you think are suitable for your post-war training program?

T. W. I. Courses Beneficial

About one year ago the War Manpower Commission established a branch in San Francisco to conduct classes in "Training Within Industry." Since that time 285 of our shop supervisors have taken a course entitled "Job Instruction Training," and 47 have taken a course in "Job Methods Training." These courses consist of a ten-hour program spread over five days, two hours each day. We have found them very beneficial.—*B. M. Brown, General Superintendent Motive Power, Southern Pacific.*

Special Training For the Supervisors

The present critical situation brought about by the unusual work load, incident to the present high traffic volume being handled by the railroads, has clearly shown the need for the use of some improved special training methods designed to better fit the present and prospective supervisors to handle effectively the problems pertinent to that situation.

To better judge the special training necessary, some study of the needs therefore is paramount. Those needs are known to arise primarily through the following:—

1—Shortage of help.

2—The necessity to train quickly new or unskilled men to fill positions requiring skill beyond their past experience.

3—The need to understand how quickly to adjust daily routine to compensate for abnormal absenteeism.

4—How to handle and maintain discipline among female employees.

5—How to minimize unrest which is permeating all the railroad organizations due to dissatisfaction with the present wage schedules.

6—How to obtain greater effectiveness of production from the available help in order to offset the present shortage, and at the same time raise production to meet the demand for increased output of railroad equipment.

The achievement of this special training has been attempted through three general classes of instruction:

1—Those sponsored by government agencies, including Job Instruction Training, Job Relations Training, and Job Methods Training.

2—Foremanship conferences, sponsored by management, but based on courses offered by national training institutes, and

3—Foremanship conferences sponsored by state universities.

All of these methods have been found to be of value and each to have its merits and its limitations.

Experience has shown that the success of any one of the methods depends largely upon the following factors:

1—The interest and enthusiasm displayed by management's general supervisors in the welfare of their subordinate supervisors and the support given to them during their training period, together with proper recognition of the activity and progress shown by those receiving the training.

2—The selection of well qualified leaders to carry on this instruction.

3—The proper training of these leaders before they are allowed to undertake the promulgation of the instruction.

4—Careful selection of the subject matter and the method used in its presentation to the trainees.

Some of the pitfalls found to have been responsible, to a large extent, for the failure of the trainees to get the most out of the special instruction are:

1—Any attempt to coerce supervisors into taking part in these instructions and conferences instead of presenting the matter to them in such a way that their participation is voluntary and enthusiastic.

2—Careless selection of instructors and conference leaders.

3—The use of subject matter and job illustrations not particularly adapted to the industry in which these trainees are employed. Definitely, lack of interest and enthusiasm can be expected if the problems, the jobs and the methods used for illus-

trative purposes are not a part of the everyday work-life of the trainees. The railroad supervisor or prospective supervisor cannot be expected to maintain an interest and enthusiasm during a discussion on some problem or job which may be of vital interest to, say, the automotive industry, but which has no definite application in his shop.

4—The teaching of one thing in the conferences and continued practice of another in the actual operation of the shop quickly breaks down any good obtained through the conferences.

5—The failure on the part of management to take proper recognition of and action concerning constructive suggestions procured through the conferences.

Hundreds of mechanical department supervisors and prospective supervisors have now completed training courses, some of which have been highly successful, and many of which cannot be so classed. The need for continuation of special training is as great, or greater, than was the need for its original institution.

It is time to take stock of the situation and revise these programs so as to exclude the bad, include the known good features, inject such new material as a change in the national picture may require, and then make available to those who have not yet had the opportunity, instruction which they are, as a whole, anxious to obtain.

From the experience gained during this emergency it is probable that a training system which is made from the cream of all the present experimental systems will be of continual value to the railroad mechanical departments after the present emergency is over.—*F. K. Mitchell, Asst. G. S. M. P. & R. S., New York Central.*

Testing Training Methods During the War Emergency

We have been very much concerned with the methods used in the training of both supervisors and mechanics, and have resorted to the following procedures in an attempt adequately to train our personnel.

Training of Supervisors

At the present time we have a number of new supervisors on our railway. They are good mechanics and know their work, but some of them are weak in handling men; they lack the ability to teach other employees to do the job quickly, and some of them are lacking in the ability to handle grievances properly. To correct these deficiencies, we have tried the following:

1—We sent our master mechanics and shop superintendent a weekly letter, published by a reputable company, on management information. The master mechanics and shop superintendent were to use this as a basis of discussion in their staff meetings. It was thought they might be able to glean from this weekly letter some good ideas and policies to be used in directing subordinate supervisors. This method was tried for sometime, but was abandoned as we did not think we were justified in continuing this service.

2—We next tried a series of manuals on foremanship training. The supervisors were asked to study the manuals and then a discussion was held once a week in connection with other matters. This method was unsatisfactory because the supervisors were, in a large number of instances, too busy or too tired to study the manuals; and the text matter in these various manuals was largely a reiteration of what the supervisors already knew. Since we did not consider that we were gaining anything from the study of these manuals, the discussions were discontinued.

3—At one of our larger shops we recently tried the "Training Within Industry" program as put on by the War Manpower Commission. We selected three of our key supervisors and they attended lectures given by the assistant district representative of the War Manpower Commission for a period of one week. The supervisors who attended this conference felt that the training which they received was beneficial and worthwhile, and we decided to extend it to all of the supervisors in this particular shop. So far we have not definitely determined the value of this "Training Within Industry" program.

4—Another method used in training supervisors is by making use of Voca-films on subjects relating to safety, maintenance problems, and labor relations. These films are scheduled for showing at various shops at a definite time, and all supervisors are notified. We have our assistant superintendent motive power-personnel make a short talk before showing the films. This method has been particularly effective, and has a more lasting impression upon the supervisors than the lectures and discussions we have had heretofore. The fact that our assistant superintendent motive power-personnel takes these pictures around to the various shops creates the desired impression of their importance. We think this method of training supervisors will be useful in post-war programs.

Training of Mechanics

The regular apprenticeship training system is of long standing, and is covered by rules with the shop craft labor organizations. We have two forms of apprenticeship training—regular apprenticeship, and helper apprenticeship.

Regular apprentices serve four years, and are selected from young men between the ages of 16 and 21. Our requirements are that they must be high school graduates. We have, however, in some cases hired sons of employees as regular apprentices who have not completed their high school education. Approximately 50 per cent of our regular apprentices are the sons of employees.

Helper apprentices are selected from helpers who have served not less than two years as helper. Helper apprentices serve three years, and are given the same general training as regular apprentices.

Heavy inroads have been made on our apprentices by the Selective Service Act, and we are no longer training young men as regular apprentices. We are now appointing our mechanics from helper apprentices and from qualified helpers who have served four years or more as helper. We are also upgrading qualified regular apprentices to mechanics after they have completed two years or more on their apprenticeship.

Our practice, which is of long standing, is to promote laborers to helpers. We are now conducting a shop training school as a wartime necessity and in order to better qualify men to perform railway shop work. The trainees of this school are laborers employed in our shops and non-employees who desire employment in our shops. The non-employees attending this school get the same instruction as employees. This school is conducted three times a week, at night. One of the requirements for the non-employee trainees is that they be not immediately subject to the draft. The purpose of this school is to instruct trainees in the fundamentals of shop work, to stimulate their thinking, and by means of lectures, increase their general knowledge.—*G. S. M. P.*

On the Pittsburgh & Lake Erie

We have had some experience with the government subsidized job instruction training and job method training of our supervisors at McKees Rocks. A number of the supervisors completed these courses and have certificates of graduation. It is obvious that the men who received this training gained some personal benefit from it.

The difficulty lies in the practical use of this knowledge for the purpose of training new and inexperienced men. The Pittsburgh & Lake Erie has agreements with the shop crafts providing for a stipulated number of apprentices to be graduated, also a stipulated apprentice schedule—both helper and regular—in order to assure them an all-around knowledge of the trade by the time they graduate. This system has been in effect for years and every foreman whom these apprentices contact during their apprenticeship has been their instructor for the respective time allotted to each department. We consider that this system has been very successful, and will continue to be successful as long as we are mutually subscribing to the kind of labor agreement mentioned. We also, at times, assign a special apprentice instructor, who assists the apprentices when needed.

This method is recommended for the future, also for the post-war reconstruction period. Regardless of the working conditions mentioned, we do not wish to minimize the importance of having supervisors trained along some approved standard lines with reference to their contacts with apprentices, as well as other employees under their jurisdiction. It seems important that such standard methods and instructions should in all cases be given by highly experienced men who themselves have a considerable amount of familiarity and experience along the lines of work on which they are giving instructions.

With reference to new employees, such as laborers, helpers and mechanics, other than those who enter the rosters on completion of apprenticeships, we also call attention to the fact that shop craft agreements provide that the already established

employee may select or bid in his assignment, having preference over a newly hired employee. It is therefore impossible to know beforehand any details of the kind of work a new employee is to do, and it is necessary to give him the required instructions after he has been allocated to the particular job or place that he is permitted to take, after priority rights of older employees have been satisfied. These rights, granted by the agreement, are guarded very closely by the employees, and no deviation is generally found.

At the present time and for the immediate future, we will, no doubt, be compelled to train new employees in the above prescribed manner, male and female, in order to give them the necessary knowledge of the job after being placed in their respective positions.—*K. Berg, Supt. Motive Power, P. & L. E.*

Supervision Benefited

The State of Michigan assigned a group of instructors, available to all industries, to give a course of lectures and demonstrations, free of cost to the participants, this instruction program being termed "Training Within Industry." All of our local supervisors and some of the lead men were enrolled. Without going into details, it has proved to be of considerable value to them in the handling and training of men on new jobs. As one foreman remarked, "The way to find out how little you know about the details of some equipment is to try and explain it to someone else."—*Shop Superintendent.*

Special Training For Machine Operators

Toward the close of last year we were having considerable difficulty in keeping our machine tools continuously in operation, particularly in our large machine shops at Juniata, because of the number of men who were being furloughed for military duty, or who for other reasons were not continuously at work.

In order that we might meet the demands of the railroad for repair parts for locomotives and provide the necessary machined parts for new locomotives under construction, it became necessary to correct this situation. Accordingly, we arranged to set up a training program for machine operators on the various types of machine tools. The men selected for this training are given experience on a number of machine tools of the respective types, with machine operators selected on the basis of their ability to instruct new men. The training period covers a definitely specified time which, as above indicated, is allocated to selected machines and operators. For example, trainees for positions as engine lathe operators are given experience on five different size lathes during the training period.

The progress of these trainees is followed up by a supervisor who has been assigned to that particular duty and who reports currently on their progress.

This program has provided us with trained operators available for filling temporary vacancies which occur on account of sickness or for other reasons, and makes available men for permanent vacancies as they may occur. It has worked out very satisfactorily and has very much reduced the idle machine tool hours which were lost prior to its adoption. The trainees are paid on an hourly basis during the training period.

Our method for training supervisors has been in effect for many years and has proved entirely successful. It is our practice to develop from among our working forces, by constant observation, those who possess the necessary mechanical ability and supervisory qualifications to lead and direct the work of other employees. This method has been employed continually and up to the present time there has been no occasion to adopt new or different methods during the period of this emergency because of lack of trained persons among our working forces to promote to supervisory positions.—*F. G. Grimshaw, Works Manager, Pennsylvania, Altoona, Pa.*

Two Methods of Training Supervisors

It has been our privilege to enjoy the benefits derived from two special training methods for supervisors. The Job Instructor Training course offered by Training Within Industry, an agency of the War Manpower Commission, was first completed by our supervisors. This was a ten-hour course, divided into five two-hour sessions. This wartime measure proved successful in teaching supervisors how to break in new workers and instruct old workers how to do a job properly. A noticeable result from this training was the realization on the part of each supervisor that better results could be obtained more easily when instructing employees, by following the methods set up in the Job Instructor Training course. This training proved to be a revelation, as it demonstrated the inadequacy of our method of instruction to workers.

We are convinced that the application of this training by our supervisors in instructing their men how to do a job has paid dividends in conservation of man-hours. Heretofore, an excessive number of hours was lost by both the supervisor and employee in learning the job; and a higher degree of efficiency has been obtained by the workmen. This has resulted in increased production and improvement in quality of workmanship.

All features of this training are applicable for our post-war training, as the principles are sound and will apply at all times.

Our supervisors have also had the privilege of attending a series of "roundtable" discussions conducted by the state director for Vocational Training for War Production Workers, under the title of "Foremen Improvement Conferences". This was a series of conferences held weekly at the shop. A choice of subject matter was offered, with a suggested list of topics deemed particularly adaptable to our railroad problems. These conferences were led by a duly accredited leader who was particularly qualified, being a student of trade and industrial education. All conferences were conducted on the plan of every member participation.

Such topics as safety first, teamwork and co-operation, introducing new employees to the organization, how to correct or reprimand workers, the foreman as a leader, and costs of locomotive repairs at shops as related to foremen and supervisors, were among those discussed, and much value was derived from the facts developed in these human relations and operating problem topics.

A definite plan was followed in conducting these conferences in order that worthwhile conclusions would be reached. It was customary to follow this outline: State topic, define its purpose, discuss topic, draw conclusion. Pertinent information brought out by the group was recorded and developed into a composite report at the conclusion of each conference, each member being provided with a copy for his personal file at the next meeting.

We are convinced that much value was gained from these conferences, as evidenced from the interest manifested, the after-meeting groups which voluntarily formed to continue discussion, and the active participation of every member. Direct application of the many suggestions brought out in these conferences has resulted in an increase in efficiency of effort, better control of waste and scrap, substantial reduction in operating costs and closer interdepartment co-operation.—*K. D. Read, Asst. Supt. Locomotive Shop, N. Y. C., Beach Grove, Ind.*

Visual Methods Coupled With Conference Discussions

The problem of setting up special training methods for supervisors and mechanics is of accepted importance in these days of scarcity of manpower.

Training programs that worked in normal times can only be successful today on an accelerated basis. The Railway Educational Bureau is applying the fundamentals of practical instruction which we have developed through the years to this problem. We are adapting visual training methods to our present programs. Sound slide films, 16 mm. motion sound and silent films are being used in conference discussions among supervisors to present visually a statement of certain specific problems.

A few of the problems so presented are: training understudies, statement of a supervisor's responsibilities and duties in wartime, specific training aids for machinists, welders, electricians, etc.

We are utilizing the conference and visual methods of training more and more daily, correspondingly diminishing the use of text material. Apprentice instructors representing seven major railroads agree that the results being obtained through the new training plan are very gratifying not only

with apprentices, but with mechanics and foremen. Frankly, this new method is merely the application of good selling and advertising tactics to a sound training program.—*R. C. Buell, The Railway Educational Bureau.*

Baltimore & Ohio Practices

The Baltimore & Ohio has three groups of apprentices—regular, helper and special. Regular and helper apprentices are instructed in all branches of the work of a particular craft. Special apprentices are instructed in all branches of the work handled in the maintenance of equipment department, and are required to have a technical educational background.

Those who are adept in the work which they are performing are considered for supervisory positions after they have completed their apprenticeship. It might be said, therefore, that supervisors are "hand picked."

We are continually urging all of our employees, both workmen and supervisors, to avail themselves of all means of securing additional knowledge that is available —by attendance at courses in schools and colleges conducted by the various states and municipalities, as well as those sponsored by the federal government. Any lectures that are called to our attention are given wide publicity. We also urge all to take advantage of the instructions through the various correspondence school courses, such as the International Correspondence School and others.

We have also instituted job instructor training sponsored by the War Manpower Commission. The course has not been extended to all supervisors through the system yet, but instruction is progressing. In view of the comparatively short time since it was started, we are not in a position to make a definite statement as to results that are obtainable.—*A. K. Galloway, General Supt. Motive Power and Equipment, B. & O.*

Roundtable Discussion on Diesel Maintenance

Question—What particular problems are giving you concern in the servicing and maintenance of Diesel locomotives? Have you found it necessary to provide special facilities and organization other than those required for steam locomotives? What?

Labor Problem Is Serious

There are still many perplexing problems to be solved in the operation and maintenance of Diesel power road locomotives. One of the most concern is the labor problem; it seems that the enginemen continuously want to do less work and demand more pay.

The maintenance problem has not been so acute in that practically all of our maintenance forces are willing to perform their duties to the best of their ability; but the trouble is again in the labor organization, because when a certain mechanic or an electrician with outstanding ability is in line for advancement, he cannot be assigned to the job for the reason that others who have greater seniority demand that they be given that place, even though it is known that they do not possess the desired qualifications Nevertheless, such men must be trained, or at least tried out for several months, regardless of the unsatisfactory service rendered. Of course, any outstanding employee can be promoted to supervisor or foreman, but it is just out of reason to employ all of them in such a capacity. Someone actually has to do the work in a careful and precise manner, which is not always done when forced to use men who are more or less indifferent to new ideas and standard practices.

Repairs and current maintenance of Diesel electric locomotives are entirely different from the work performed on a steam locomotive, in that the Diesel demands closer attention to its many moving and intricate parts, all of which must be accurately fitted and assembled to within at least .001 inch. Some parts, such as fuel injectors, etc., are finished with still greater precision, all of which demands the attention of specialized and highly skilled mechanics.

As time goes on and Diesel power begins to predominate on the railways, the special maintenance facilities will gradually be improved and perfected, all of which will be an incentive for the younger and mechanically-minded men to study and fit themselves for such work. Right now we have a special committee making surveys on other lines, with the intent and purpose of making recommendations for modern maintenance facilities, which we intend to establish as soon as the committee completes its assignment.—*E. F. Weber, General Supt. Automotive Equipment, Burlington Lines, Chicago.*

Suggestion on How to Minimize Dirt Nuisance

One of the most obstinate problems in connection with the maintenance of Diesel switching locomotives is that of keeping the working parts clean. Dirt is the root of all evil on a Diesel. This is true of the electrical equipment, as well as the mechanical. It would be no exaggeration to state that 50 per cent of the routine work on a monthly inspection consists of cleaning operations.

Diesel switchers usually work in a dirty industrial section of town. To the dirt from adjacent factories and steel mills is added the smoke and cinders from steam locomotives. The dirt is drawn into the engine compartment, after which it is blown down into the traction motors. The engine room is always under a partial vacuum and therefore tends to draw in any soot or sand in the air.

It is possible that this condition might be reversed. Instead of sucking the cooling air into the engine room it could be blown in. This would tend to keep the air in the engine compartment at slightly over atmospheric pressure, which would automatically prevent the infiltration of dust. There could be one large blower fan located at the front of the locomotive. This fan would receive its supply of air through filters and would deliver clean air to a pressure compartment. From the latter there should be suitable ducts leading to the traction motors, to the air compressor, to the engine room and possibly to the radiators also. By the introduction of nothing but clean filtered air to the various working parts, a material reduction in maintenance could be expected.—*J. E. Kloss, New York, Chicago & St. Louis, Buffalo, N. Y.*

Special Facilities Required

We have difficulty in securing men for servicing and maintaining Diesel locomotives who have sufficient training in both electrical and mechanical work to take care of both the Diesel engine and the electrical traction motors, generators, control equipment, batteries, etc. Especially where there are only a few locomotives at one station, it is desirable that the service men be qualified in both the electrical and mechanical work. At larger centers this can be taken care of in much the same manner as steam power; that is, electricians taking care of the electric work and machinists handling the mechanical maintenance.

We have found it necessary to have men with special training in Diesel electric work to supervise the operation and maintenance, and certain special facilities also have had to be installed. Tools specially designed to take care of the work on the pistons, cylinders, cylinder heads, fuel system, etc., have had to be provided and it has been found desirable to furnish lockers for the smaller tools, so that they are available to all concerned. Also, the cleaning filters on the lubricating oil systems and the apparatus used for filtering the air for the Diesel engine have required tanks and cleaning apparatus not commonly provided for the steam locomotive work. Where the number of locomotives in service warrants the use of apparatus for changing wheels, we have installed a drop table to permit quick change of wheels or traction motors.—*A. H. Williams, General Supvr. of Apprentice Training, Canadian National.*

Extensive Railroad Demand Developing For

New Shop Equipment

Having entered the war period with shop facilities from 25 to 40 years old the pressure of history-making traffic and high speeds are showing up the old tools

WHEN the United States entered World War I in 1917 the repair facilities of American railroads were in far better physical condition to take on the burden imposed by the peak loads of wartime transportation than they were when we entered World War II in 1941. A large part of the most important railroad repair shops, engine terminals and car repair shops were either built new or rebuilt and equipped with up-to-date machinery in the early years of this century. As a result, when war broke out in 1918 most of our more important railroad repair plants were relatively new and well equipped to do the job of that period. While no record is available of the average age of all machine tools in service at that time it is a reasonable assumption that it was not excessively high.

The purpose in making the above statements is to direct attention to the fact that the 10 years after the end of the last World War marked the end of a long period of repair shop construction and major installations of machinery and equipment. Since 1930 expenditures for new shop equipment have been sporadic and, except for one or two scattered instances, have been definitely limited in any one year to total amounts considerably below previous 10-year averages.

In 1934, during the regime of the Federal Co-Ordinator of Transportation, surveys were made to determine the possibilities of effecting economies by the replacement of obsolete machine-tool units with modern machines. In the course of these investigations it was found that in the typical locomotive repair shop of that period the average age of all machine tools was 20 years and that in 75 per cent of the machining operations performed in the course of locomotive and car-repair work the replacement of 20-year-old machines with the new tools of that period would effect savings, in many instances, of as much as 80 per cent of the cost of doing a specific job.

Nine years have gone by since those studies were made and while there have been several instances of major replacement programs the volume of such installations has not been great enough to stabilize the average age of tools in most of our shops. Result: in 1941 the roads faced the greatest traffic in all of their history with a shop machinery inventory, in most cases, considerably in excess of a 25-year average age. It is no wonder, then, that in the 22 months since we entered the war those who are charged with the responsibility of operating our repair shops and engine terminals have become more and more conscious of the inability of 25- to 40-year-old machine tools to hold up their end in a production battle such as present-day traffic imposes on those shops. It is surprising how many of the machine-tool units installed in shops built between 1900 and 1915 are still the mainstay machining units in the plant.

In those instances where specialized departments were completely modernized with new machinery and where new units have been installed in departmental groups the value of the new machines and the handicaps of the old machines have been especially marked. There are numerous instances where units and groups of new machines have paid for themselves in five years or less and when they were purchased there was no expectation that they could be amortized in even two or three times that period of years.

When a situation in which the demand for machine tools for equipping defense plants practically made it impossible for the railroads to secure new equipment was immediately succeeded by the establishment of the priority system that added to the difficulties many mechanical men began to realize that possibly the intention to replace obsolete tools with new ones had been postponed somewhat beyond the point of safety. Only by the exercise of latent ingenuity and the most intensive utilization of shop equipment were many roads able to keep up with the ever-increasing demand for motive power and car equipment. It is not surprising, therefore, that many shop men who may have previously been somewhat indifferent to the value of new equipment should develop an interest in the acquisition of new facilities such as has not existed for some years. In all fairness it should be admitted that not until the past two years have shop operations been at a sufficiently high load rate to show up the major shortcomings of old machinery and the obvious advantages of modern machinery. In any event, wartime traffic has created a vast demand for new railroad shop equipment and there is now no longer any doubt that this demand must be supplied if the standard of wartime transportation service is to be maintained.

Results of a Broad Survey

Early in this year two things became evident: that the railroads must have new shop equipment if they were to keep motive power and cars in first class serviceable condition; that the needs of defense industries, passing as they were from the construction to the production stage, were lightening the demand for machine tools sufficiently to make it easier for other industries, particularly the railroads, to obtain badly needed units.

With the idea of finding out exactly the nature of these needs the *Railway Mechanical Engineer* made a study of conditions and requested brief and specific information from 43 of the most important Class I roads, 39 of which co-operated by making known their requirements for shop machinery. These railroads represented 71 per cent of the route mileage, 80 per cent of the steam

locomotives, 74 per cent of the Diesel-electric locomotives, 97 per cent of the electric locomotives and 74 per cent of the freight cars.

In approaching a study of this kind it was our desire to find out as much about the underlying reasons back of the demand for new equipment in car and locomotive shops as it was to determine the character of the equipment required. This for the reason that there have been an increasing number of indications over a period of several months that our railway repair plants are destined to become a factor of first importance in the continuing ability of the railroads to carry the wartime load, and that the capacity of these shops to do this job is now reaching a stage where machines may be more important than manpower. Such a statement may seem like a contradiction except for the explanation that when the supply of manpower is static or diminishing and hours of work have reached their practical maximum the remaining solution to increased output is new facilities of greater productive capacity.

This assumption is definitely borne out in the replies that were received to the question, "For what reason are these machine tools needed?" The greatest number of roads, 28 out of the total, gave the necessity for increased output a place of prime importance while close behind this reason, in importance, was that of the need for greater accuracy in machining operations. This reason was given by 26 roads. Relief for an increasing manpower shortage was the reason why 21 roads needed new equipment and 16 of the 39 roads gave the desire to decrease the cost of machining as a reason. It seems superfluous to add that the replacement of obsolete machine tools with modern equipment will accomplish all of these objectives simultaneously.

We have had a suspicion for some time that extended periods of high-speed and heavy-tonnage operation of both freight and passenger trains would have a definite effect on specific shop operations. For that reason we asked these roads to tell us what shop departments were most in need of new tools and the replies on this basis were:

Car wheel shop	24 roads
Turret lathe department	20 roads
Driving wheel work	19 roads
Rods and rod bushings	16 roads
Piston and crosshead work	13 roads
Driving box departments	12 roads

There is significance in the fact that wheel work is right up at the top of this list and bears out many observations that wheel shops are having more and more difficulty in keeping up with their output schedules because of the inability of old machine tools to turn out accurate work in large quantities. It is ironical that modern locomotives and cars, operated at high speeds, should demand infinitely higher standards of accuracy in wheel, axle and bearing machining from shop equipment of a character and condition least able to furnish it. The mounting tempo of the demand for new wheel shop machinery is not, therefore, in the least surprising when these conditions are taken into consideration.

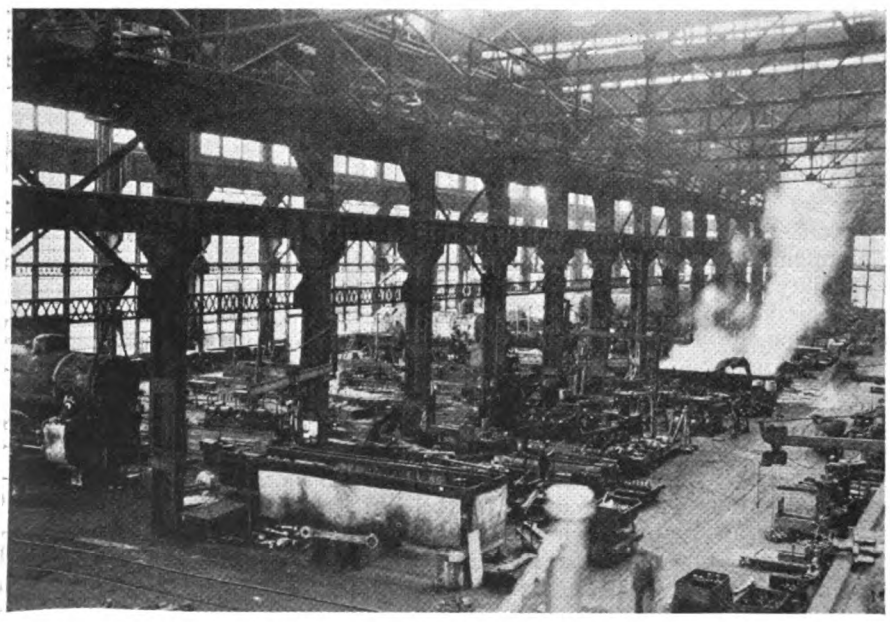
What Type of Machines Are Needed

An analysis of the types of machines needed reflects a growing need for new engine lathes, turret lathes, vertical turret lathes and boring mills, vertical and radial drills, grinders, milling machines, shapers and horizontal boring machines. The scope of the demand and some indication of relative importance of demand can be seen in the accompanying tabulation of the number of roads, out of a total of 39 reporting, asking for machines of the specific types listed.

Demand for Specific Types of Machines

Engine lathes	27 roads
Turret lathes	20 roads
Drilling machinery	21 roads
Vertical boring and turning machines	21 roads
Grinding machines	21 roads
Milling machines	18 roads
Shapers	12 roads
Horizontal boring and milling machines	10 roads

It is rather difficult to draw specific conclusions from an analysis of types of machines required but there is one that seems reasonably safe from contradiction. For years, one of the major obstacles to the installation of new machines, particularly those of the more expensive variety, has been the lack of volume in machine work from the standpoint of the number of parts required. Lack of volume has operated to forestall opportunities for maximum economies in machining. Wartime traffic has provided volume in locomotive parts production far beyond anything previously experienced. Those roads with new machines have watched with amazement the ability of these modern machines to take on a seemingly limitless burden of new work and do it in a manner and at a cost that establishes a violent contrast to the mediocre ability of the 25- or 30-year-old machine. Here, before the eyes of every shop supervisor, is eloquent proof of what the production industries have known for years. While the picture of modern machine-tool efficiency is fresh in the minds of railroad shop men there should be established the means of making it necessary for every old machine tool either to justify its existence or be thrown on the scrap heap.



The concluding part of our survey was the question "When are these machines needed—now or in the post-war period?" All but four roads stated emphatically that the need is *right now*. Some roads reported that they had programs for the replacement of shop equipment in the post-war period in addition to their needs at the present time.

Six Committees Present

Electrical Section Reports

THE Electrical Section, Engineering Division, Association of American Railroads, has received five technical reports in addition to the report of the Committee of Direction. In lieu of an annual meeting of the Section in October, 1942, the Committee of Direction held a meeting in New York on November 18, 1942, for the purpose of reviewing the reports of the committees. No meetings except those of members of individual committees have been held this year. Two items have been approved and published in the 1943 Supplement to the Manual. These are: (1) Form of Agreement for Purchase of Electrical Energy for Other than Traction Purposes, and (2), Specifications for Rubber Insulated Wires and Cables No. 18 AWG and larger. A committee of four to represent the Section on war emergency activities has been functioning during the past year.

The Electrical Section was represented by one of the members of the Committee of Direction on the Special Committee on Blackout of Railway Equipment. The conclusions reached as the result of the tests made have been embodied in a report that has been filed with the authorities concerned.

An appropriation of $2,000, authorized by the Association for use in 1943, has enabled the research staff of the Engineering Division to make commendable progress in an investigation of electrolytic corrosion of steel in concrete. An additional allotment of $1,000 has been endorsed for use in 1944. The report of the Committee of Direction is signed by D. B. Thompson, N. Y. C., chairman of the Electrical Section.

The work of the technical committees has continued the important functions of the organization although no general meetings have been held in 1943

Electrolysis

The work done by the Committee on Electrolysis during the past year has consisted of (1) establishment of a special test to determine resistance to ground, amount of current flow, and corrosion of steel embedded in different thicknesses and kinds of concrete under controlled conditions in the field; and (2) the study of a catenary pedestal at Collinwood, Ohio, on the New York Central, which in the past has shown an excessively large current flow.

For the purpose of the first test, six-inch concrete cubes containing various mixes of concrete with and without additional admixtures to increase electrical resistance were made up, measured dry, and after various periods of immersion, contacts to the blocks were made by coating two opposite faces with sprayed copper. In the comparisons, cubes made of concrete containing an admixture known as Morene showed the highest relative resistance. The other admixtures did not seem to increase the resistance appreciably relative to that of concrete containing no admixture.

Following the laboratory tests with the cubes, field specimens have been made up consisting of cylinders having outsider diameters of 5 in. and 13 in., respectively, and containing at the center a 6 ft. section of 1 in. diameter steel rod. These test specimens consist of one each of the following three admixtures: Morene, celite, and hydrated lime. These units will be placed in the ground and subjected to an electrical potential over a considerable period of time. Measurements will be made periodically of the current flow and potential; and at the end of the test, the steel rods will be removed from the concrete and the corrosion loss determined.

The catenary footing tested at Collinwood, Ohio, consisted of a concrete base with four anchor bolts on which it was found there was an occasional current flow of as much as 150 amp. between the catenary supporting structure and the ground. By jacking up the supporting structure, insulating it from the footing, insulating each anchor bolt separately, and insulating guy wires, it was possible to determine the course of the leakage current. This was done by placing batteries and an ammeter between the anchor bolts and ground. The negative side of the batteries was connected to the structure and the positive to the anchor bolt.

It was found that one anchor bolt had a resistance to ground much lower than the others and it is believed that the low resistance resulted from ground water coming in contact with either the anchor bolt or reinforcing steel in the footing. The report also states it seems probable that flaws in the concrete footing may have been a primary factor.

The report is signed by A. E. Archambault (chairman), N. Y. C.; R. Beeuwkes, C. M. St. P. & P.; D. P. Dickie, Western Union Telegraph Company; Paul Lebenbaum, So. Pac.; P. L. Mathewson, Can. Nat'l.; W. P. Monroe, consulting engineer; G. K. Shands, Virginian; J. S. Thorp, D. L. & W.; H. P. Wright (vice-chairman) B. & O.; J. M. Trissal, Ill. Cent., and S. M. Viele, Pennsylvania.

Transmission Line And Catenary Construction

Committee No. 3 on Overhead Transmission Line and Catenary Construction has participated with authorized representation of the Edison Electric Institute in the preparation of Specifications for Electrical Supply Lines at Crossings with the Facilities of Steam and Electrified Railways. Pending a final agreement between the two groups concerned, emergency specifications for crossings have been established. These are as follows: Electric light, power supply and trolley lines crossing over or under the tracks and facilities of railroads shall conform, in general, to the requirements as set forth in

Part 2 of the Fifth Edition of the National Electrical Safety Code, issued September 23, 1941.* However, where the crossing is of sufficient importance to require greater strength of supporting structures than specified therein, the transverse strength shall be approximately 50 per cent greater than specified in the case of wood poles, and approximately 30 per cent greater than specified in the case of steel towers. Railroads shall cooperate with power companies to keep them advised as to the types of crossings which are considered as requiring this additional protection.

In states where the above conflicts with regulations issued by duly authorized authority, such regulations will govern.

The report is signed by K. H. Gordon (chairman), Pennsylvania; H. F. Brown, N. Y. N. H. & H.; P. B. Burley, Ill. Cent.; P. M. Fey, B. & O.; S. W. Law, No. Pac.; John Leisenring, Ill. Cent.; R. A. Mylius, Virginian; S. R. Negley, Reading; J. S. Thorp (vice-chairman), D. L. & W.; S. E. Noble, C. & N. W., and P. E. Snead, Southern.

Electric Heating and Welding

The report of Committee 5 on Electric Heating and Welding is concerned entirely with safety precautions to be followed in electric welding. Major items covered in the report are as follows: While voltage across the arc may range from 20 to 140 volts, on open circuit it may vary from 60 to 120 volts. This comes within a range that should be handled carefully. Even greater care should be exercised on the higher supply voltages.

From a safety standpoint, machines should be selected for (1) quality of workmanship and insulation; (2) shielding of electrical connections and windings from moisture; and (3) guarding of energized parts from human contact.

Periodic inspections should be made to determine any exposed or energized parts; to measure open-circuit voltage; to record machine insulation resistance; to test for voltage between primary and secondary windings of transformers to see that voltage does not feed back through the secondary to an unused transformer when such devices are connected in parallel; to watch for glow in the tubes rectifiers under "no-load conditions"; to make regular inspections and insulation tests of cables, plugs, receptacles and feeder lines. Attention is also called to the use of a ground circuit through the plug, receptacle, conduit and conduit ground. Periodic tests of the ohmic values of such circuits should be made.

Attention is called to the importance of a well insulated electrode holder, the use of suitable gloves and when necessary the insulation of the operator from ground by dry boards or insulating blankets. Insulated electrode containers are also recommended which enable the operator to clamp the new electrode into the holder without grasping it in his nongloved hand. Goggles and helmets without light leaks must be used and the shades of filter glasses, tentatively standardized by the American Standards Association, suitable for electric welding are listed in the table.

Other persons working in the vicinity of welders must be protected by adequate shields or should also wear goggles for protection. Warning signs and roped-off and barricaded areas are also recommended.

Shade No. 5—Light electric spot welding.
Shade No. 6—Arc welding up to 30 amp.
Shade No. 8—Arc welding and cutting exceeding 30, but not exceeding 75 amp.
Shade No. 10—Arc welding and cutting exceeding 75, but not exceeding 200 amp.
Shade No. 12—Arc welding and cutting exceeding 200, but not exceeding 400 amp.
Shade No. 14—Arc welding and cutting exceeding 400 amp.

Burns may be caused by direct contact with live parts, by molten metal, or by radiant energy from the welding arc. Means of protection include suitable clothing in addition to the usual accessories such as goggles, hand shields, helmet shields, etc. Screens and walls should be protected by paint which does not reflect ultra-violet light. First-aid equipment should be available for treatment of burns and the personnel should have instructions in its use.

Welding operations conducted out-of-doors ordinarily require no special precautions to protect against gases, fumes and smoke. In enclosed areas excessive fume concentration may necessitate the use of special ventilation or respirators.

Fire hazards include the welder's clothing and nearby flammable objects. The report states that welding and cutting operations must not be permitted in or near rooms containing flammable vapors or liquids and that the welders and their helpers should be constantly alert to detect and promptly extinguish any fire. Caution is also recommended to avoid welding or cutting on closed vessels in which internal pressure may be caused by the heat of the welding.

The report is signed by C. A. Williamson (chairman), Texas & New Orleans; L. S. Billau, B. & O.; S. J. Fairbanks, Waterloo, Cedar Falls & Northern; H. E. Gannett, C. & N. W.; J. E. Hawe, Gr. Nor.; C. P. Kahler, U. P.; F. A. Linn, Ill. Cent.; R. P. Winton (vice-chairman), N. & W.; J. C. McElree, Mo. Pac., and G. K. Shands, Virginian.

Track and Third-Rail Bonds

At a meeting held on November 18, 1942, the Committee of Direction authorized the submission of specifications for welded bonds, for letter-ballot approval on condition that Committee 9 accept certain suggested revisions. However, because of questions that arose within the committee in the study of these revisions, which led to proposals for still other modifications, it was deemed best to withhold the specifications from the letter-ballot and present them to the Section again as revised. Accordingly, the specifications are submitted in the 1943 report for adoption and publication in the Manual.

The types of bonds included in the specifications are welded rail-head U-bonds and extended bonds. The specifications cover: Purpose; Drawings; Tender; Alternates; Material and Workmanship, Design; Conductors; Terminals; Identification; Resistance of Installed Bonds; Purchaser's Order Requirements; Inspection; Tests; Marking; and Warranty.

The report is signed by Paul Lebenbaum (chairman), So. Pac.; B. E. Arias, Nat'l Rys. of Mexico; W. P. Bovard, Ohio Brass Company; H. F. Brown, N. Y. N. H. & H.; J. H. Davis, B. & O. (retired); H. H. Febrey, American Steel & Wire Company; C. G. Lovell, C. M. St. P. & P.; H. G. McMillan, N. Y. C.; J. S. Thorp (vice-chairman), D. L. & W.; R. A. Mylius, Virginian;

* Issued as National Bureau of Standards Handbook H 32, Safety Rules for the Installation and Maintenance of Electric Supply and Communication Lines, comprising Part 2 and the Grounding Rules of the Fifth Edition, National Electrical Safety Code. Copies may be obtained from the Superintendent of Documents, Washington, D. C. Price 65 cents.

S. R. Negley, Reading; C. R. Wadham, Ill. Cent., and L. C. Walters, Southern.

Illumination

The report of Committee 10 on Illumination, which is a very brief report, reads as follows: A considerable amount of information has been assembled on the subject of fluorescent lighting, application, economic value, etc., but due to drastic restrictions on material of this kind, it is the opinion of this committee that publication of an extended dissertation at this time would be of academic value only. The period covering the remainder of the restrictive period will undoubtedly see further developments which would make obsolete a part of the information now in hand; hence it is thought to be advisable to withhold a report thereon until a more active interest will be served.

Discussion of the subject of the control of lights at outlying points, where no regular attendant is available, brought out the suggestion that a switch be provided at an accessible point and that local air-raid wardens be authorized to operate the switch as required. This appears to be the simplest solution involving the least use of critical materials. Where no regular railroad attendant or air-raid warden is available, it will be necessary to resort to individual study and treatment.

The report is signed by E. R. Ale (chairman), Pennsylvania; D. M. Burckett, B. & M.; H. F. Finnemore, Can. Nat'l Rys.; W. F. Freutel, C. & O.; J. E. Gardner, C. B. & Q.; H. A. Hudson, Southern; G. T. Johnson, N. Y. N. H. & H.; S. D. Kutner, N. Y. C.; L. S. Billau (vice-chairman), B. & O.; R. A. Mylius, Virginian; Frank Ross, Terminal R. R. Assn.; G. L. Sealey, Reading, and C. P. Trueax, Ill. Cent.

Cab Signal Tests Made on the Turntable

The usual arrangement for making cab signal tests on locomotives entering or leaving the enginehouse is to have the approach tracks equipped with insulated track sections to which the necessary track currents can be applied. The locomotive must stop at these positions and in some locations it is necessary to have as many as seven tracks equipped.

The Chicago, Rock Island & Pacific has greatly simplified the usual arrangement by making the tests on the turntable. Insulated cables carrying the test circuits are run along the web of each rail on the turntable and these are supplied consecutively with the four types of impulses by means of a sequence timer.

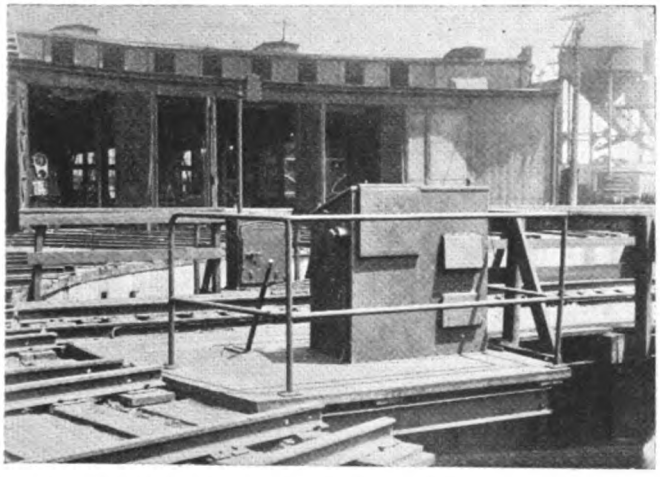


Fig. 1—The doorknob switch for starting the cab signal test is mounted at the left on the turntable control cabinet—One of the signal positions may be seen on the opposite side of the turntable

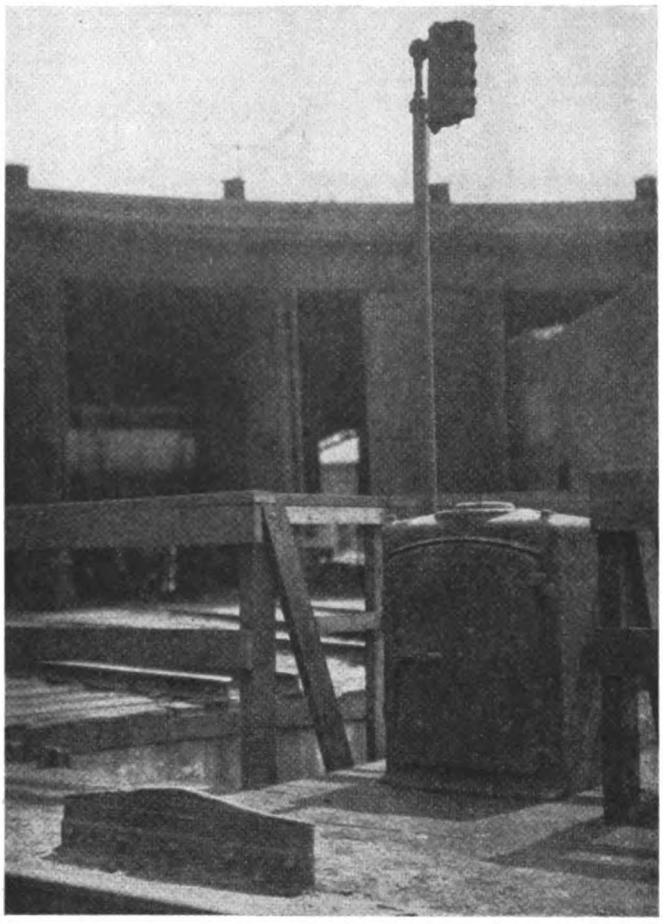


Fig. 2—One of the signal positions with the control equipment housed in a discarded wayside signal case mounted at one end of the turntable

After the locomotive is run onto the cable, the turntable operator turns the small knob shown on the left side of the turntable controller in Fig. 1. This starts the sequence timer which in turn supplies the four signals, one after the other, to the track circuit. At each end of the turntable there is a cab signal indicator which produces signals corresponding to the impulses in the track circuit. The man in the locomotive checks to see that the signals received in the locomotive correspond to those shown at the ends of the turntable.

The test may be made while the turntable is in operation and usually requires less time than it takes to move the table. The locomotive is stopped only once and only one test location is required.

It will be noted from the illustrations that old signal cases are used to house the control apparatus. These are weather-proof and the railroad has found a variety of uses for them in the operation of pumps and other control equipment which must be placed out-of-doors.

The ramp shown in the foreground in Fig. 2 is used for checking the automatic train control equipment which is being replaced by the new four-indication cab signal system, for operation with the C. T. C. system on the main line between Blue Island and Rock Island, Ill.

Enginehouse Heating

How can a group of unit heaters be controlled to meet the requirements of heating an enginehouse?

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York.

There is always the danger that a locomotive may be moved onto or off a turntable when the rails are not properly lined up. Can you suggest a system of signals or other means which will tell the hostler when the tracks are properly aligned?

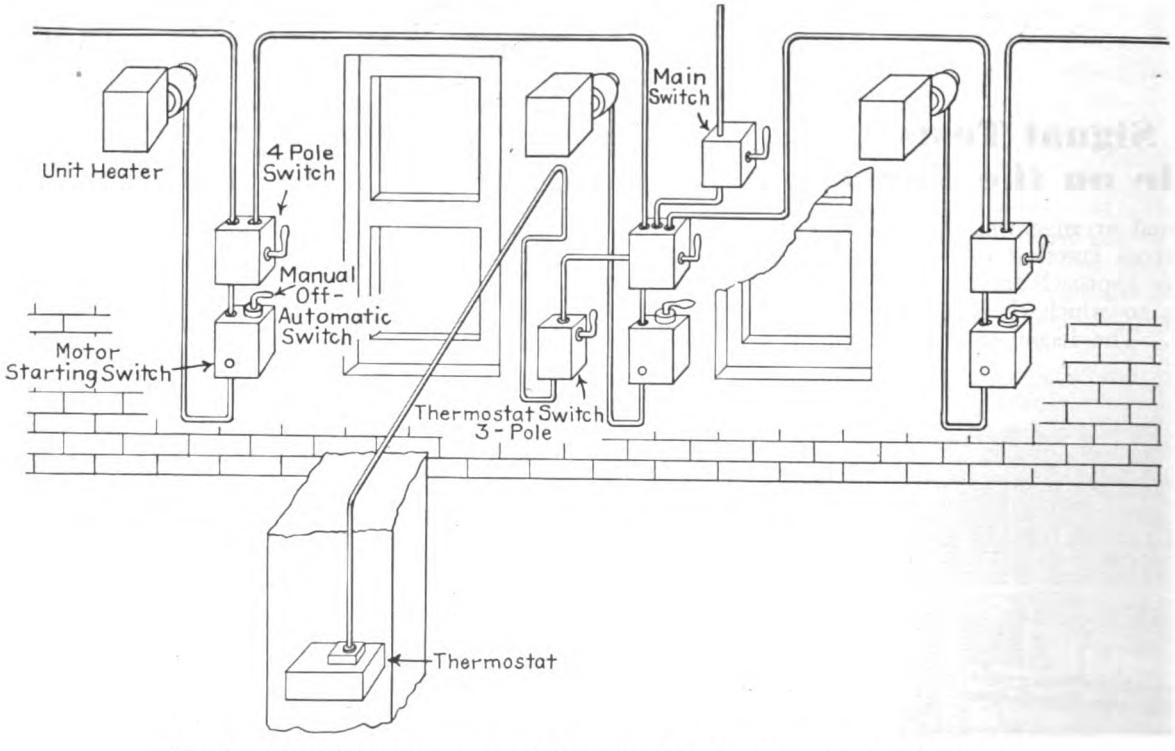
Control of Unit Heaters For Enginehouse Heating

One modern way to heat any large industrial area is by means of unit heaters. A locomotive enginehouse is no exception to this rule. To be sure the rigors of enginehouse service, such as smoke and gas, are especially hard on unit heaters as well as on the equipment used to control their motors. Furthermore it should not be forgotten that unit heaters, like any other type of equipment, must be properly maintained in order to retain their original efficiency. Nevertheless, unit heaters when properly installed and adequately maintained will prove themselves not only satisfactory, but also economical devices.

The control of a large group of unit heaters is a problem for the electrical department to solve. One method of accomplishing this is to control all heaters, which are located in one section of the enginehouse, from one of two master thermostats, but at the same time to provide local control for each individual unit. A wiring diagram and a location plan for such an arrangement are given in the sketches which form a part of this article. These diagrams show the master control for a centrally located unit heater together with one unit heater located on each side. It is of course an easy matter to expand the illustrated installation by simply adding four to seven unit heaters on each side of the central location shown. The only precaution which has to be taken is to make sure that neither the wires nor the control devices are overloaded.

The location plan shows the control equipment together with the unit heaters mounted on the inner face of the outside wall of the enginehouse. The unit heaters and other equipment are placed on pilasters between the windows. In some cases it will be desirable and necessary to install a unit heater at every pilaster, while in other cases one unit heater on every other pilaster will suffice. The decision as to how many units are needed can best be made by a study of the number of B.t.u. required by the house for the minimum outside temperature which is expected. Any heating sales engineer will be more than glad to help make this important decision.

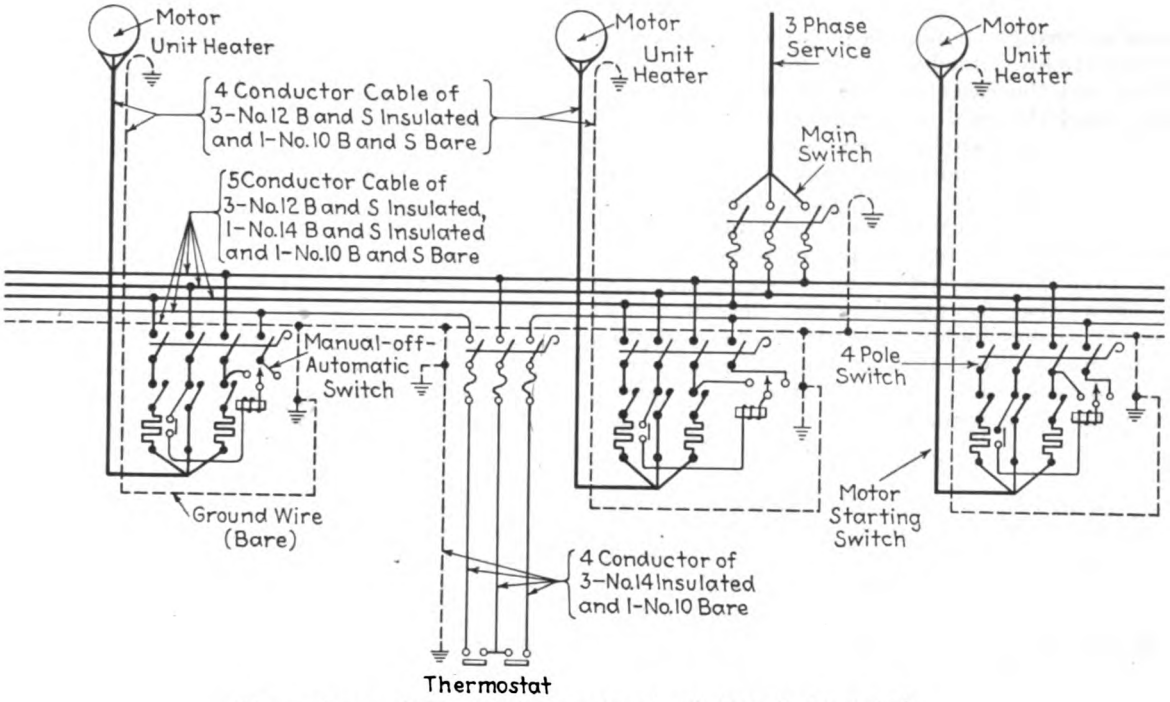
It will be noted that sketches show the thermostat control as being placed on one of the posts located toward the center of the house. It is usually desirable to have the thermostat located some distance from the heaters, and it is of course essential to have the thermostat placed in the area where control is desired. The various elec-



Location plan showing arrangement of thermostat, control equipment and unit heaters

trical units are shown connected by means of cables. Cables similar to service entrance cable has been found to be very satisfactory when used in enginehouse service. The cable required for an installation similar to that shown will have to be obtained on a special order in view of the fact that the cable sizes specified are not standard stock items. With this in view the diagrams have been marked in order to show the number and size of conductors required for each run.

The service cable can be made up of any sized wires



Wiring diagram showing the master control and three heater controls

depending on local conditions, but it is suggested that nothing less than three-conductor No. 8 B. & S. be used. The distribution circuit uses a five-conductor cable which contains three No. 12 B. & S. gauge conductors as the 220-volt feed for the motor-starting switches, one No. 14 B. & S. insulated conductor as the control wire, and one bare No. 10 B. & S. conductor as the means for grounding all units. This ground wire is essential when cable is used, otherwise the various units of the system might become dangerously charged. Since in some sections of the country the laws are more rigid than in others, it is important to remember that the suggestions as to the size of conductors should be increased where local conditions require.

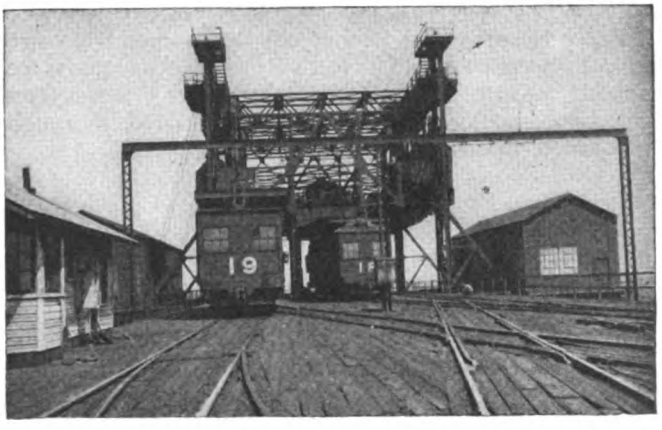
If we assume that the motors furnished with the unit heaters are one-half horsepower, three-phase, 220-volt units, then the electrical equipment needed to equip three complete stalls of an enginehouse is as follows: two 30-amp. 220-volt, three-pole safety switches (for main and thermostat); three 30-amp. 220-volt, four-pole, non-fused safety switches; three 220-volt, three-pole coil-operated, across-the-line motor starting switches equipped with over-current protection of the proper rating for ½-hp. motors; three "manual-off-automatic" control switches; and one 220-volt, double-pole, single-throw thermostat of the proper current carrying capacity to carry the load of the coils in the motor-starting switches.

A four-pole switch is necessary at every motor location in order that the control circuit may be opened every time that the starter is disconnected from the line. If a three-pole switch were used, someone opening the three power wires might think the motor-starter switch to be completely de-energized, whereas in reality the control circuit might still be alive. The manual-off-automatic switches may be eliminated, if it is thought that sufficient control can be obtained from the thermostat, but it has been found from experience that workmen differ as to the amount of heat they need. Furthermore, if the manual-off-automatic switch is located in a locked box or is one of the lock type switches, it provides an excellent means of supervising the heating system. With lock type switches a foreman can "lock out" or "lock in" any unit heater.

Most unit heater installations will have some type of pump for returning the condensate to the boilers. If this pump is motor driven it may be connected to the three No. 12 B. & S. conductors in the distribution cable and thus save the expense of running a separate circuit just to take care of the pump.

FORD C. PETHICK

* * *



Electrically-operated transfer cars carry coal from road car dumpers to ship loaders on the Virginian, at Sewalls Point, Va.

Drying Out Electrical Machinery

A number of our a.c. and d.c. machines remained submerged for four days during a recent flood. What is the easiest way of restoring these machines to service?

Circumstances Control The Method To Be Used

The easiest way of restoring to service a.c. and d.c. machines or their control equipment which have remained submerged for four days is largely governed by the facilities readily available for drying, reconditioning and testing and the extent of the urgency.

Water-soaked electrical apparatus is usually dried in some sort of heated drying oven before being placed in service. When the emergency is very great, however, low-voltage machines may even be hurriedly freed from mechanical obstructions such as mud and other foreign matter, the bearings relubricated and placed in operation, preferably unloaded for a few hours. Experience shows that the use of modern insulating materials and varnishes highly resistant to the absorption of moisture make this drastic method of treatment in some cases possible until a more thorough job can be done when the time permits.

Cleaning

Water is a conductor of electricity and its conductivity increases with dirt and chemicals. Flood waters contain such impurities. The apparatus must therefore be completely disassembled and all parts thoroughly washed with a high-pressure hose. The water pressure applied to insulated parts should not exceed 25 lb. per sq. in. Where chemicals, oil or grease is to be removed, the temperature of the water or the solvent mixed with it should not exceed 190 deg. F. The parts are then wiped dry with lint-free clean cloths—not waste—with particular attention to insulation and shafts. If oil or grease still remain, the parts can be wiped with or dipped in a solution of naphtha, carbon tetrachloride or gasoline or their suitable mixtures. To prevent the formation of explosive or toxic mixtures when using inflammable solvents, adequate ventilation should be provided and potential sources of fire minimized. Sparks produced by striking metal tools, metallic spray nozzles and metallic parts of shoes should be avoided. Fire extinguishers should be within easy reach and the personnel should be familiar with administering artificial respiration.

Inspection

After cleaning and wiping, all parts should be carefully inspected and all defective or weakened parts renewed. Bearings, whether of the open or sealed construction, should be completely disassembled, thoroughly cleaned, dried and relubricated.

Drying

In drying electrical apparatus, the most satisfactory temperature is about 230 deg. F. If the control of temperature is not quick and positive, it is better to work at lower temperatures in order to avoid damage to insulation. Drying can also be carried out at temperatures lower than 230 deg. F. but the period of drying will be longer. This period usually varies from two to six days. A small or non-waterproof machine will absorb moisture and also dry in a shorter period than a large machine with a winding fully impregnated against moisture. In order to keep dry, insulation which has been dried, it is necessary to maintain a minimum temperature of about 105 deg. F.

Heat may be applied externally, internally or by a combination of both methods.

In applying heat externally, the type of heater to be used is usually determined by what is available. This may vary from a heated vacuum tank to a hastily rigged drying oven of sheet iron, wood or even building paper heated by any means from electric space heaters, warm air blown under forced draft, steam or hot water radiators, coal or oil stoves, or even open fires. The use of open fires and their fumes are usually avoided to minimize fire hazards and defacing of equipment and property. When circumstances necessitate the use of open fires, baffles should always be used to avoid contact of flame with the equipment. A ventilating opening should be provided at the top of the enclosure to allow the escape of moisture and gases. Adequate air circulation must be provided within the enclosure. The temperature of the oven should be constantly checked to prevent overheating and damaging the parts being dried. In the case of large machines, it is often more convenient to build the heating oven around the machines without the necessity of handling its heavy parts.

In applying heat internally, competent supervision is essential. The fraction of rated voltage applied to produce the drying circulating current should be kept low enough to prevent current flow through the insulation.

Heat generated internally cannot be dissipated readily. Internal heat produces gases and vapors which may injure insulation in escaping. Moisture also lowers insulation resistance and at high temperatures renders insulation more susceptible to breakdown. While the winding is still wet, a temperature of even 212 deg. F. may lower insulation resistance sufficiently to cause damage to the insulation.

In the case of low-voltage equipment, drying is often omitted, especially when the equipment is needed urgently. After a thorough cleaning and inspection, the machine is reassembled and operated unloaded at reduced voltage until forced ventilation and internal heat caused by a limited circulating current dry out the windings and insulation. The insulation resistance first drops due to the inverse temperature characteristic of insulation and moisture, then rises as the insulation dries out. As the insulation resistance rises, the applied voltage may be increased until rated voltage is reached. The machine is then operated at rated voltage and no load until an insulation resistance of 1 megohm per 1,000 volts operating voltage is reached. For machines with operating voltage less than 1,000, the minimum insulation resistance is also 1 megohm.

Some parts of electrical equipment are harder to dry than others and require more attention; for example, coils wound with many turns of relatively light wire such as d.c. field windings, contactor operating coils, and transformer windings. Commutators are also hard to dry.

The most satisfactory method of drying coils and commutators is the hot vacuum process. This apparatus can only be installed and economically operated in a manufacturing plant or large repair shop where frequent use will warrant the investment in equipment and maintenance of competent operating personnel.

The next best method of drying coil insulation and commutators is the combined external and internal heat method but, in this case too, the investment required in responsive temperature control and its accurate measurement together with the competent operating personnel

may be too costly an installation for the average requirement.

Oven drying is probably the most economical method. Where a permanent oven installation is available, electrical machines operating in damp locations as well as submerged apparatus may be economically dried and reinsulated.

In the case of oil-cooled transformers, the tank may be drained and converted into a drying oven. Heated air is blown through the bottom oil valve and allowed to pass through the ducts and around the windings. The moisture-laden air is then discharged through an opening at the top. The temperature, measured by the resistance method, is kept under close observation to avoid damage to windings and insulation.

When a commutator in operation is suddenly cooled by cold flood waters, a considerable amount of moisture or water may be absorbed into it. In removing this moisture or water, it is sometimes necessary to provide a drain hole. This may be done by removing some bolts or nuts holding the commutator together. When the V-ring is held with a threaded ring, the segments should be held together with one or more clamps in order to maintain the smooth surface alignment when removing the V-ring. Heated air is then blown through these openings or the commutator is placed in a drying oven and then temperature constantly checked to avoid injury to the insulation.

Insulated cables may be dried with circulating current or by applying external heat. In the case of cable insulation containing rubber, a temperature of 140 deg. F. should not be exceeded.

When the apparatus is in the process of drying, Megger readings should be taken periodically. Any winding that fails to register a satisfactory insulation resistance after a reasonable length of time of constant temperature drying, may be considered to have developed a permanent fault and should be investigated closer for the possibility of removing such fault or, if necessary, of rewinding.

Testing

While the actual value of insulation resistance varies greatly in various types, sizes, voltage ratings and insulating materials of electrical apparatus, the relative values of these resistances when dry and when subjected to moisture and other destructive influences, are of major significance. The trend of the change in the value of insulation resistance rather than its actual value is to be considered. A satisfactory insulation resistance test is therefore considered sufficient for replacing an apparatus in service.

In the case of coils, it is important to note that a high resistance Megger reading does not always preclude the possibility of shorts between turns. After a winding tests clear, therefore, it should be connected in series with similar coils known to be in good condition and its resistance compared by the drop method.

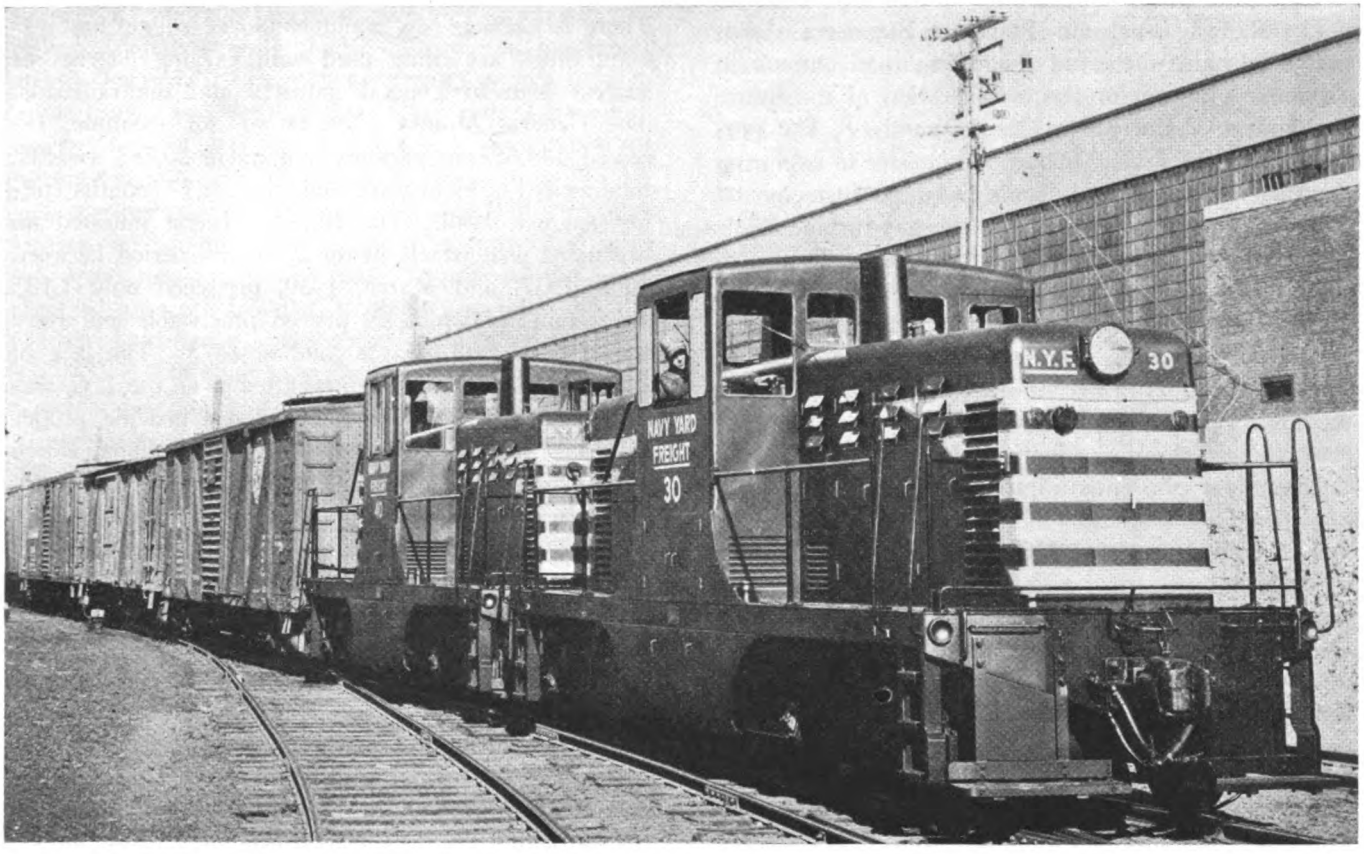
A high-voltage dielectric test is not ordinarily applied to such reconditioned machines. If required, however, such a test should be made when the insulation is cold and its dielectric strength relatively higher.

Operation

The dried and tested apparatus is finally reassembled completely, lubricated if necessary, and energized, if possible, at reduced voltage; then at rated voltage, without load. The load is then applied gradually and the machine kept under observation for some time.

R. G. Cazanjian,
Electrical Engineer,
Brooklyn, N. Y.

* * *



Two 380-hp. 44-ton G-E Diesel-electric locomotives being used in multiple-unit operation for heavy switching requirements

EDITORIALS

Association High Lights

Organizations of men develop individual characteristics by which they can be recognized that are almost as distinctive as the qualities distinguishing individuals from each other. Of course, the obvious distinctions among the four so-called coordinated mechanical associations are the fields of their activity. But beyond them there are differences of outlook which are reflected in the character of at least a part of the work each association has done during the past several years.

Such a characteristic which comes to mind with respect to the Master Boiler Makers' Association is the consistency with which its program each year has contained at least one topic which reaches out to broaden the outlook of its members beyond the bounds of their own immediate interests. During the past five years the members have learned something of the functions of the federal Committee on Apprenticeship of the United States Department of Labor; of a steam-generating research conducted at Purdue University, and of boiler feedwater treatment and its relation to corrosion and maintenance. The members have been kept abreast of current theory with respect to caustic embrittlement. They have been informed of advanced engineering data which may influence future locomotive boiler design.

The Railway Fuel and Traveling Engineers' Association has also displayed a similar broad outlook in becoming a forum for the consideration of the future possibilities of the gas-turbine locomotive. The persistent effort of L. P. Michael's committee in exploring the various engineering details has been instrumental in spreading the conviction that the gas turbine has a bright future as a locomotive prime mover. This association has two heritages—one from the old International Railway Fuel Association and the other from the former Traveling Engineers' Association. It honors both ancestors in the influence it is exerting toward the improvement of railway fuel statistics and in its leadership in the dissemination of knowledge and enthusiasm for the intensification of locomotive utilization.

The Car Department Officers' Association has inherited the tradition of a long period of useful service rendered by the Chief Interchange Car Inspectors' and Car Foremen's Association. While its program is much broader than that of the old association, it still renders the same useful service of culling out and recommending needed changes in the Interchange and Loading Rules to committees of the Mechanical Division of the A. A. R. which formulate the recommendations for the official action of that body.

The Locomotive Maintenance Officers' Association is a relatively new body which came into being after its predecessor, the old International Railway General Foremen's Association, had been inactive for some time. It can scarcely be said to have inherited any useful tradition from that body and seems to be having some difficulty in finding itself. That there is a definite field within which it can function usefully is clearly demonstrated by the discussions of six questions pertaining to locomotive maintenance presented elsewhere in this issue.

Present conditions, no doubt are greater handicaps to the continued functioning of a new organization with a short background of experience than they are to the older and better established organizations. None of these bodies can continue to carry on successfully without the willingness of the officers and many of the members to do its work at real personal sacrifice. The useful service they can render, both to the railroads and to their members, should be the source of ample inspiration and personal satisfaction to assure the continued operation of all of these associations always provided, of course, that these leaders have a clear vision of the opportunity.

Suggestions From Employees

There is nothing new about employee suggestion systems which are being used with varying degrees of success both by general industry and the railroads. The General Motors Corporation, for example, received 134,657 suggestions and made 20,783 awards, totaling $814,553 in war bonds, in the 17 months ending August, 1943. The Illinois Central initiated an organized plan which, in the 21-month period between June, 1937, and March, 1939, produced only 1,135 suggestions of which 29 proved practicable and were the basis of cash awards totaling $475. The lack of complete success in this initial attempt on the I. C. was laid to a poor set-up which did not provide proper channels for the consideration of suggestions, which lacked necessary publicity to enlist the interest of employees, and which provided inadequate monetary recognition to award winners.

In an address before the September meeting of the Chicago Car Foremen's Association, H. C. Marmaduke, present manager of the I. C. Employees Suggestion System, said that the prospects for enlisting employee interest and improving management-employee relations through a suggestion system are unlimited, based on the sound theory that the man behind the wheelbarrow, engine lathe or desk knows more about his particular job than anyone else. Once his interest is aroused and he is given both an opportunity and

an incentive to suggest and develop worth-while ideas, not only will safety and working conditions be improved but the company's products and services as well.

Instead of operating as a company-committee plan, the present I. C. suggestion system has been functioning with notable success for over a year as a joint labor-management plan designed to stimulate the production of transportation badly needed in the war effort. In Mr. Marmaduke's experience, six cardinal principles which are necessary to the success of any suggestion system include: "Complete anonymity on the part of the employees making the suggestions up to the time awards are announced; the active enthusiastic backing of topflight management, utmost fairness and thoroughness in the consideration of ideas; generosity in the making of awards; full-time supervision; and most of all, company-wide faith in the plan, combined with a willingness on the part of all actively engaged in its direction to work hard and long to put the enterprise over."

The "proof of the pudding is in the eating" and the suggestion plan now followed by the Illinois Central has resulted in increasing the number of suggestions received from 16,092 in 1939 to 21,545 in 1942, with more than proportionate increases in 1943 to date. The number of awards made on the basis of suggestions received was 1,147 in 1939 this number being increased to 3,166 in 1942. The amount of money authorized to cover these awards increased from $10,565 to $35,120 in 1942 or an average of a little over $16 for each suggestion. A minimum award of $5 is paid for ideas of a minor nature, and suggestions which eliminate a hazard or otherwise increase safety of operation receive a minimum award of $10. There is no maximum award but where suggestions result in measureable savings, awards approximating 10 per cent of the gross savings for the first year are given to the employees responsible.

The experience of the Illinois Central with this suggestion system indicates its value in connection with the drive for war production. Typical of the ideas received are: the installation of electric lights on the footboards of new Diesel locomotives as a safety measure—intangible benefits, award $10; use of a die for punching instead of drilling slots in the throttle latches of certain types of locomotives—estimated annual saving $100, award $10; place lattice work over a cinder conveyor so constructed as to increase safety when the bucket is in the pit—intangible benefits, award $10; use special post or "old man" to increase efficiency when drilling trailer frames for fulcrum holes on certain classes of locomotives—estimated annual saving $250, award $25; rearrange slides over stoker troughs on locomotive tenders to avoid leaving coal in the tender with resultant deterioration, as well as to minimize the number of stops required to take coal, working conditions also being improved—annual tangible benefits $2,500, award $250; do away with all-copper hammers for inspection work and use instead soft-steel hammers with copper inserts in each end, this arrangement proving economical and at the same time saving copper for the nation's war effort—the savings were estimated at $2,200 per year and an award of $220 was made; a further check developed actual savings to be $2,877, and an additional award of $68 was made to the suggestor, total award $288; use industrial propane gas instead of artificial gas and thus reduce operating costs $4,000—award $400.

The suggestion system carried to its logical conclusion applies to all departments of railroads and also covers potentially the important field of inter-departmental relations. It deserves and, where successful, receives the support of both railroad managements and employee representatives who serve on the general committees and have voting power along with the railway officers on these committees. The objectives of reduced hazards, increased efficiency and money saved to be made available either for job permanency or increased employment are goals which everyone can agree on as desirable.

Others, Too, Are Working

Over a period of many years the work of the four mechanical associations has contributed greatly to progress on the railroads. In many instances they have been the prime movers in the adoption of new or improved practices which have added to efficiency of repairs or technical advances in design. For all of this they are to be commended and participating committee members thanked for the sacrifices in personal time which have been made in order that all might share in the knowledge and experience accruing from study and experimentation carried on in the mechanical departments of American and Canadian railroads.

There are, however, other sources from which equally valuable contributions have come and we feel that these efforts should also be called to mind in this issue which features the work of the mechanical associations. Private research as carried on by various supply companies and equipment manufacturers has done much to improve the quality and the performance of both motive power and rolling stock. University research laboratories have contributed to the development of improved materials, to improvements in equipment design, and to the sum total of engineering knowledge affecting the efficiency of railway operation. The A. A. R., through its committees, is continually investigating and testing the desirability of changes to improve design and performance.

Other technical societies of the country contribute directly or indirectly to the common fund of knowledge which is available to railroad men. The Railroad Division of the A. S. M. E. is among those whose work has been directed primarily to the dissemination of advanced knowledge pertaining to both theory and

practice of rolling-stock design. At its last meeting held in Chicago from October 18 to 21, the American Welding Society devoted a session to the consideration of welding and allied processes as applied to railroad needs. Other groups, while not as close to the railroad field, provide valuable factual information which is utilized in one way or another by the railways.

Attention is directed to these facts with no thought of minimizing the work of the associations, the reports of which are printed in this issue. It has been done, rather to suggest to what a great extent the railways are dependent upon organized efforts outside of their own operating forces for improvements in materials, for advances in the design of their own facilities and for improvements in practices.

Sometimes Scrap Is New Material

Since the outbreak of war and the consequent shortages of material there has been so much emphasis placed on the collection of scrap that we are sometimes inclined to wonder if there aren't many pounds of usable material getting into the scrap pile that could serve a much better purpose as basic material. Of course we know that no one would deliberately consign usable material to the scrap pile but it isn't the deliberate action that we are referring to in this case—it is the unconscious waste of material as a result of the careless design of parts, the allowance of too much finish for machining, the selection of a bar, billet or plate out of which to cut a part that requires too much material to be cut off and thrown away.

A case in point was observed in a large shop not long ago where scrap locomotive driving axles were used to manufacture a locomotive part the final finished weight of which was 336 lb. The original "scrap" axle weighed 1,386 lb. and in the process of cutting down an axle on a flame cutting machine to produce the parts ready for machining 504 lb. of metal were cut away and discarded as far as that particular operation was concerned. In the process of machining these parts to their final finished dimensions 168 lb. more were discarded in the form of chips making a total loss of material of 672 lb. or 48 per cent of the original material.

It is our belief that in such a case the necessity of "getting an engine out" plus the lack of new material unconsciously led to the use of the scrap driving axle which, being looked upon as scrap, was viewed only in the light of the solution to an immediate material shortage problem and not as a case in which basic material was used. Axle steel is still axle steel, even after it has reached the condemning limit as a driving axle, and it is only fair to say that while the job of getting a locomotive out of the shop is the major consideration the question should be raised as to whether or not the expenditure of some labor at the forging hammer in the smith shop might not have made it possible to deliver a billet to the machine shop out of which three, or even four of the 336-lb. parts could be made, instead of one.

Freon Now Available

Some railroads report that, after trying desperately and unsuccessfully all summer to secure necessary replacement supplies of Freon for air-cooling equipment in passenger cars, they are informed that authority can now be granted to purchase limited amounts of this precious fluid. As may be surmised, the permission comes too late to be of much help to railroads in 1943.

How many supposedly air-cooled cars had to be used with this modern facility inoperative during the summer of 1943 for lack of the Freon can only be surmised. At least one road found it necessary to unseal passenger-car windows which it had spent real money to make air- and dust-tight in the original design. Another road which proposed to install equipment for cleaning Freon and making it suitable for re-use was stymied because authority could not be secured to buy the special-purpose steel pressure tanks required for holding fluid as elusive as Freon.

The heavy hand of government regulation over private affairs is no less objectionable because it is essential in a war-time economy devoted to the primary objective above all else of winning the war. More government regulation than needed to meet this objective is a detriment to the country and its institutions.

New Books

METALS AND ALLOYS DATA BOOK, *By Samuel L. Hoyt. Published by Reinhold Publishing Corporation, 330 West Forty-second street, New York. 326 pages. 6½ in. by 10 in., illustrated. Price $4.75*

This book is a compilation of data on metals and alloys for metallurgists, engineers, students and others who have need for such information. It is a book designed solely for information, not for instruction. For that reason all of the descriptive matter has been left out and by concentration on data the large field of metals and alloys is comprehensively covered in a relatively small amount of space. After introductory chapters on test specimens and hardness tests the major chapters on wrought steels, cast and stainless steels, cast iron, corrosion- and heat-resistant alloys and non ferrous metals give, in tabular form practically any information that the user of metals would require. Chemical composition, physical properties, heat treatment, specifications, properties at low and high temperatures and the results of a wide variety of tests combine to make up the complete coverage of the several types of materials. Notes on uses and selection for specific purposes enhance the value of the book.

NEW DEVICES

Car Puller

A continuous-rope, double-drum-type car puller with a maximum capacity of 30,000 lb. rope pull is being introduced by the Whiting Corporation, Harvey, Ill. The rope is counterweighted to provide frictional pulling capacity; the counterweights



Car puller which can be used with overhead or pit counterweighting

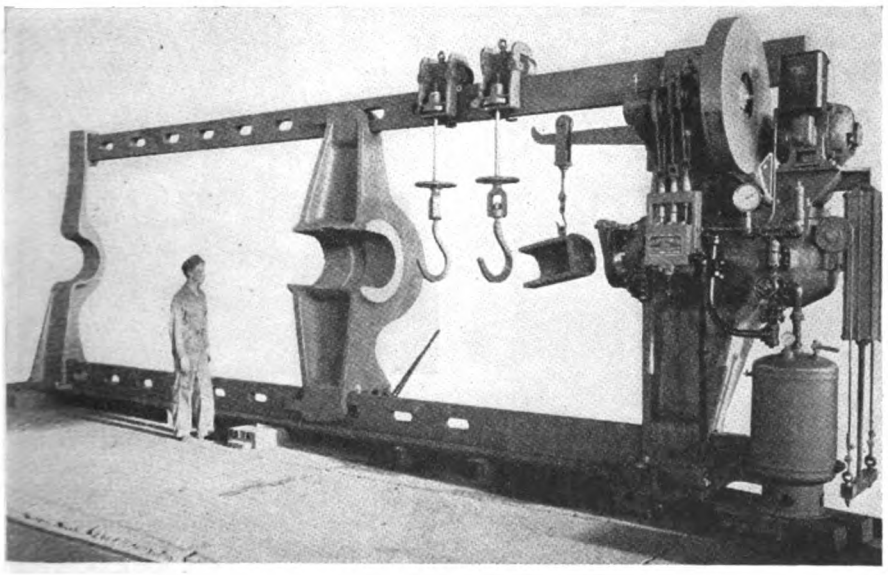
may be either the overhead type or pit type. The unit is built to fit within conventional track centers and is 4 ft. 5 in. in width. It is of all-welded construction and bearings are integral with the frame.

Hydraulic Wheel Press

The R. D. Wood Company, Philadelphia (5), Pa., has designed and built a self-contained hydraulic wheel press of 600 tons capacity. There are openings of 10 in. radius both in the resistance post and in the end post to accommodate work. The resistance post operates, on bearing equipped rollers, on the machined face of the base plate. This allows for easy movement in either direction. Where the use of a stop plate is necessary, a recess having an 11-in. radius has been provided in the resistance post, in which the plate is inserted.

The pump is of the vertical, triplex, two-pressure type. It has two high-pressure and one low-pressure plungers actuated by three eccentrics. The ram travel is 26 in. and its approach speed 70 in. per min. The ram speed at low pressure is 10 in. per min., at high pressure, 3¼ in. per min. The return speed is 40 in. per min. The maximum capacity at high pressure is 600 tons; at low pressure, 100 tons.

The press can be installed flush with the floor. A pneumatic pullback device is built into the machine which eliminates the necessity of providing a pit to accommodate counterweights and it is said to give a faster rate of ram return than is obtainable on ballast-weighted devices.

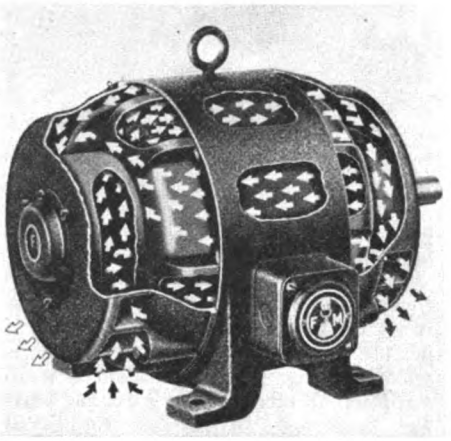


Wheel press having a 600-ton capacity

All-Purpose Motor

Fairbanks-Morse & Co., Chicago, has announced an all-purpose, continuous-duty, polyphase squirrel-cage induction motor for use in all kinds of industry. Constructed with the centrifugally cast F-M copperspun rotor, the motor is fully protected against flying chips, falling particles, dripping liquids, and other industrial motor hazards. The ball bearings are sealed in cartridge-type housings. Cross-flow ventilation, a feature in 1½-hp. to 34-hp. sizes, is obtained through protected inlets and exhausts at each end of the motor and is claimed to effect uniform cooling and the elimination of hot spots. The frame is cast in one piece with rib sections to give added strength without increase in weight.

Where space is limited, the conduit can be brought up between the motor feet to the tapped hole in the motor frame and



Sectionalized view of the F-M all-purpose motor showing direction of cross-flow ventilation

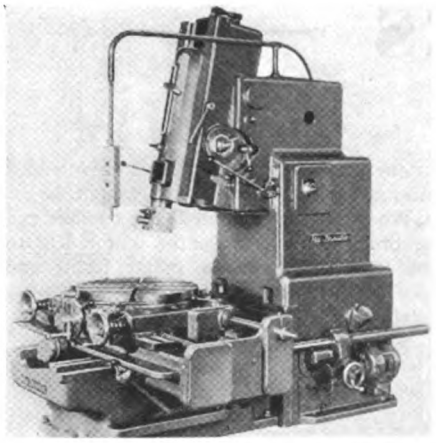
the conduit-box cover assembled flush with the frame. The external box is then discarded. When the conventional conduit box is used it can be mounted in any one of four positions.

The motor is rated 40 deg. C. and designed to carry 115 per cent load continuously without injurious heating.

Hydraulic-Ram Drive And Feeds on Slotter

The Hy-Draulic slotter manufactured by the Rockford Machine Tool Company, Rockford, Ill., has a 12 in. maximum stroke and will slot to the center of a 48-in. circle. Minimum space under the ram guide is 18 in. The cutting speeds on the machine vary between 10 and 75 ft. per min. A circular table 28 in. in diameter and graduated on the periphery, has T-slots in four directions. Micrometer dials graduated in thousandths of an inch show the exact movements of the table. Final drive to the table is through a worm and worm gear, with means provided for adjustment. In addition to rotary movement the table has a longitudinal and transverse travel of 26 in.

The slotter has hydraulic ram drive, manual and hydraulic longitudinal and transverse feed and a rapid power traverse. It also has manual and hydraulic rotary feeds to the table. The hydraulic feed to the table is infinitely adjustable between 0 and 0.106 in. per cutting stroke for transverse movement, between 0 and 0.053 in. for longitudinal movement and between 0



Hydraulic controls are a feature of this slotter

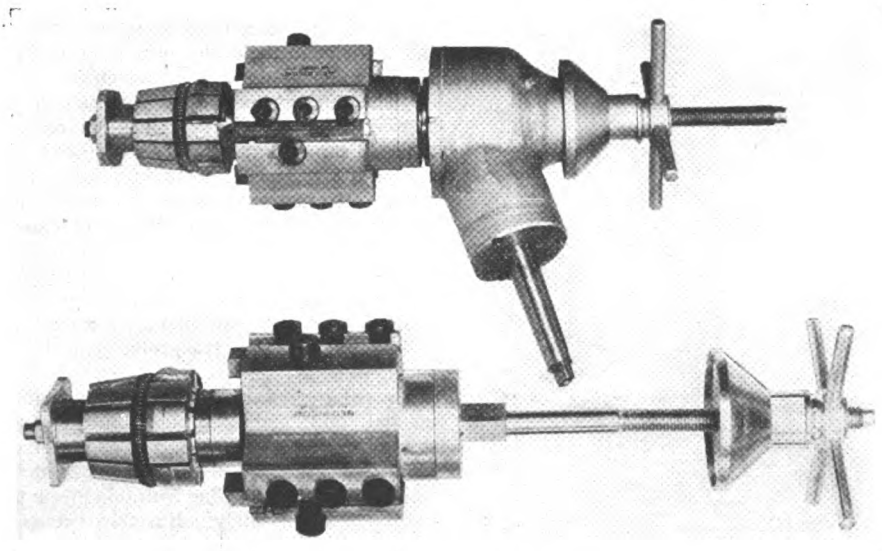
and 0.106 in., on a circle of 6 in. diameter for circular movement.

The main driving motor is a standard constant-speed electric motor connected directly to the hydraulic pumping unit by a flexible coupling. The hydraulic system is self-lubricating. Ram lubrication is automatic and all other moving parts and bearings have one-shot pressure fittings or other means for easy lubrication.

Boiler Flue Bead Remover

A Milwaukee rotary boiler-flue bead remover, recently placed on the market by Joseph Sinkler, Inc., Chicago, consists of a No. 50 motor gear angle drive unit mounted on the spindle feed rod of a three-cutter tool housing with a segmental expander which serves to center and hold the tool when it is inserted in the boiler flue. The multiple segments are held in place by a small coil spring in the usual manner. A ball thrust bearing is carried between the expander and the tool holder which is equipped with round recessed-head set screws for holding the tool bits. Power is transmitted through a motor-drive cap which engages both the angle drive unit and the tool holder. A view of the complete assembled tool is shown at the top in the illustration and without the angle drive unit below.

The cutting tools are ground with specified clearance and cutting rake and are set out all alike to the desired length from the holder by means of a tool-setting gauge which is furnished with the bead remover. When operating this tool it is recommended that care be exercised to have it firmly seated in the flue and the cutting operation continued until the tool bits have gone just deep enough to remove the beads and any pitting or scale on the face of the flue sheet. In this way the necessity of sand blasting or grinding before welding is avoided when new flues and tubes are being re-installed.

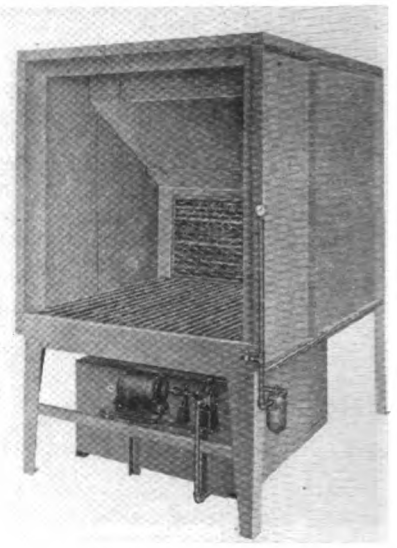


Milwaukee rotary boiler flue bead-removing tool

Spray Degreasing Booth

A spray degreasing booth intended for use in connection with solvent-cleaning operations has been designed for safe operation even with highly volatile solvents having a low flash point. It is said to remove fumes thoroughly and to deliver a forceful, hard-driven solvent spray. Available in various sizes the booths are constructed of flanged, mitered-corner sheet-steel panels which are bolted together. Deflector curtains run around the top and sides of the frontal opening.

Wire-mesh filter packs, aided by three right-angle turns in the air path, trap the atomized solvent carried by the exhaust draft, which then drains back into a pan which forms the floor of the booth. Excess solvent from the pieces being degreased also flows into this pan through the openings in the spark-proof working surface which is a heavy oak grating. From the pan the solvent is drawn by a rotary pump,



Spray booth designed for safety and high solvent recovery

equipped with an explosion-proof motor, and forced through mechanical filters which clean the solvent and deliver it to the spray gun at the pressure required. Solvent losses are held to a minimum in this procedure. The DeVilbiss Company, Toledo, Ohio, is the manufacturer of this equipment.

Machines for Woodworking

A complete line of versatile woodworking machines manufactured by the DeWalt Products Corporation, Lancaster, Pa., are available for railroad use in planing mills

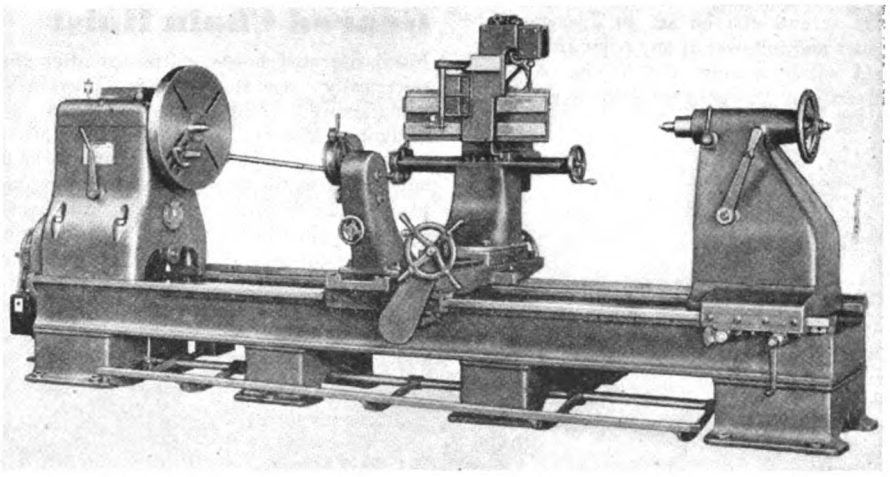


A wide variety of woodworking operations can be performed with this machine

or along repair tracks. The machines are so constructed that with three simple radial adjustments they can be made to perform almost any woodworking operation. A cantilever arm from which the motor unit is

suspended moves vertically and swings horizontally. A yoke moves along this arm and rotates horizontally; the motor can be tilted to any desired angle. This design provides for complete balance at all times because the weight of the motor is always in line with the center line of the yoke, arm and column.

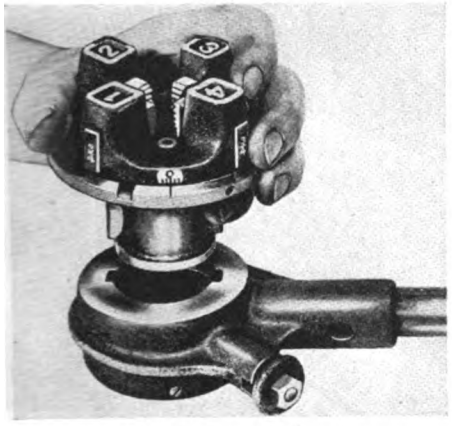
Small units mounted on movable trucks have been found valuable in saving material handling time on repair tracks and in shops because they can be spotted at or near the work under way to handle any necessary operations incident to the fitting of wooden parts.



An armature machine for the electric shop

Adjustable Pipe And Bolt Threader

A pipe and bolt threader in which complete dieheads, rather than loose dies are changed has been introduced by Beaver Pipe Tools, Warren, Ohio. This ratchet threader can be furnished with any or all of more than 100 different kinds and sizes of dies. The dies are fully adjustable for



Complete die heads are changed in this ratchet threader

cutting oversize or undersize threads and the adjustments are obtained by the use of an index which is a part of each diehead as furnished. Chips are said to clear easily and the dies can be oiled while the threading operation is being performed.

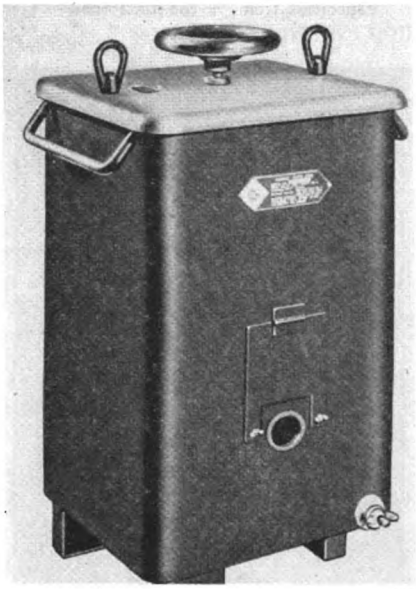
Heavy-Duty Armature Machine

The repair of large armatures, including banding, slotting, grinding and trueing of commutators, is facilitated by the use of a heavy-duty armature machine furnished by the Electric Service Suppliers Company, Philadelphia, Pa. The machine is capable of banding armatures up to 45 in. in diameter having shafts up to 96 in. long and provides a swing 47 in. in diameter over the carriage. The tension device will travel or feed to within 4 in. of the headstock centers and 8 in. of the tailstock centers.

The slow rate of revolution of the armature is 11 r.p.m., the fast rate is 80 r.p.m. Two selective mechanical speed changes are provided. It is possible to grind and true commutators 24 in. in diameter with a length of 16 in. The commutator undercutting attachment will handle commutators of from 5 to 30 in. in diameter and 19½ in. or over in length.

A.C. Arc Welder

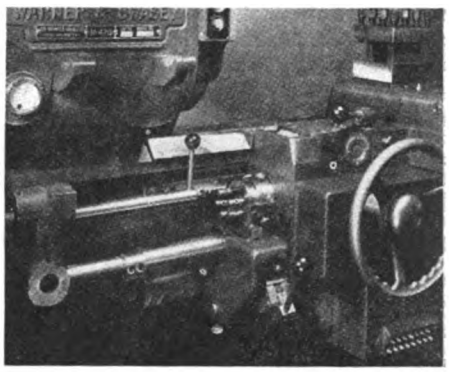
An a. c. welder with a range of current from 30 to 250 amp. known as the Ampac 200 has been announced by the Allis-Chalmers Company, Milwaukee, Wis. This machine operates to give the operator correct voltage for the continuous range of currents available, rather than using almost constant voltage at all current settings. The unit is made with an integrated reactor-transformer construction to provide a high, but safe voltage for easy welding at low currents. As with other a. c. welders the problem of arc-blow is eliminated. The welder handles rods of 1/16 in. to ¼ in. in size and most d. c. rods as well as a. c. rods can be used successfully.



A-C welder with a range of from 30 to 250 amperes

Thread Chaser

The Warner & Swasey Company, Cleveland, Ohio, has developed a new thread-chasing attachment with automatic knockoff for use on the square turret carriage aprons on A-type turret lathes. The unit



Thread-chasing attachment with automatic knockoff mechanism

bolts onto the square carriage apron and is designed so that it can be installed on lathes of the company's manufacture which are now in service.

The automatic knockoff mechanism is operated by a spring-loaded latch which is tripped by the carriage stop roll. It provides much quicker disengagement than can be accomplished by hand. The carriage

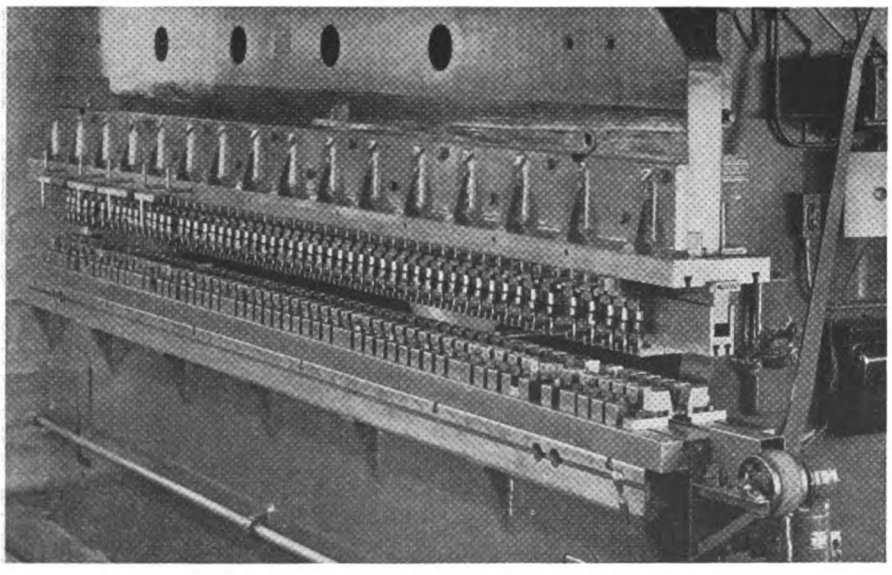
stop screws can be set to disengage the leader and follower at any point and will repeat within a limit of 0.002 in. Accurate threads can be cut from 4 to 32 per in. up to 7¼ in. in length.

Lighting Units

Engine-generator floodlight and searchlight equipment manufactured by the Waukesha Motor Company, Waukesha, Wis., is adapted to use in railroad wreck and rescue work. The two most popular units are a floodlight combination of four floodlights, and a searchlight and floodlight combination having one searchlight and two floodlights. A model with two searchlights is also available. The floodlight combination has four lights, each of 60,000 candlepower with a beam spread of 40 deg. This unit uses 110-volt incandescent lamps and is mounted on a tubular welded steel frame. The searchlight and floodlight model has one trunnion-mounted searchlight of 4,100,000 beam candlepower, and two floodlights of 60,000 candlepower each. This is also mounted on a tubular welded steel frame and uses 110-volt incandescent lamps.

Press Brake

Large size press brakes have proved of value in the fabrication of parts for both freight and passenger cars. The Cincinnati Shaper Company, Cincinnati, Ohio, manufactures these machines, the largest standard size of which is a brake which has a capacity to handle stock 1 in. by 12 ft. over an 8-in. vee die making the bend in cold metal. Gang punching equipment can be installed in the brake to speed output and provide maximum accuracy of hole spacing. A wide variation in setups is possible.

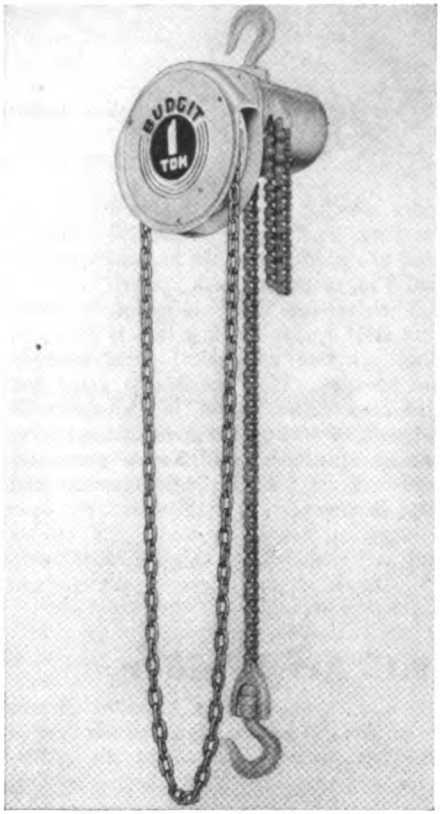


Press brake, 12 ft. long, set up to punch two rows of holes in a carline

Geared Chain Hoist

Hand operated hoists, patterned after the electrically operated hoists previously manufactured, are being marketed by Manning, Maxwell & Moore, Inc., Muskegon, Mich. These spur-geared chain hoists are available in capacities ranging from ¼-ton to 2 tons under the trade name Budgit Chain Blocks. They vary in weight according to capacity from 48 lb. to 81 lb.

The hoists have spur-gearing, anti-friction bearings on all shafts and a roller-type lift chain. The automatic load brake and other mechanism operate in a grease-packed sealed enclosure. The hand-chain wheel is housed in a steel enclosure and there is a chain guide which prevents the chain fouling on the wheel.



Chain hoists of this type can be obtained in capacities from ¼ ton to 2 tons

Rubber Bushings For Car Axle Pulleys

The Dayton Rubber Manufacturing Company, Dayton, Ohio, has developed a rubber bushing designed to facilitate the application of axle pulleys, to prevent pulleys from becoming loose, to eliminate rejection of axles due to marking and scoring by metal bushings, and to act as a rust-proof cushion. These bushings are said to be easier and quicker to install than metal bushings because both bushing and pulley are applied in one operation. No bolts, clamps or cement are required in their application to the axle; the bolts of the axle-pulley halves hold the bushing in place.



An axle pulley mounted over rubber bushings

Horizontal Spindle Miller for Railroads

Slabbing, edging and end-slotting of light link motion parts, such as radius bars, links, eccentric rods and cranks, can be performed on the horizontal spindle milling machine shown in the illustration. The head and table of the machine have separate adjustable-speed motors and profiling operations can be performed by combining

(*Turn to next left-hand page*)

SIX TESTS* HAVE GUARDED THE QUALITY OF CHILLED CAR WHEELS

...NOW A 7TH HAS BEEN ADDED

AN INSTRUMENTAL HARDNESS TEST



6/16" below the tread, Brinell hardness cannot be less than 352.

2" below the tread, Brinell hardness cannot be greater than 200.

1½" below the tread, Brinell hardness in the throat cannot be greater than 250.

To satisfactorily control the depth of chill is to ensure the *right* degree of hardness at the *right* place. Now, after 3 years' research and development, such control is possible by *instrumentally* determining chill with the Brinell Hardness Testing Machine. This test becomes the seventh requirement Chilled Car Wheels must satisfy before Association inspectors will permit them to leave any of our foundries. Thus, Chilled Car Wheel users are assured of still another control of quality.

The development of this new test demonstrates the continued efforts of Chilled Car Wheel manufacturers to produce a better wheel through rigid control supervision.

The six previously established control tests are:

1. Chill test block taken at least once in every ten wheels poured.
2. One complete chemical analysis block with each heat.
3. Constant pyrometer check for accurate processing temperature.
4. Drop test of finished wheel (A.A.R. Specifications).
5. Thermal test of finished wheel (A.A.R. Specifications).
6. Test for perfect rotundity.

SSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

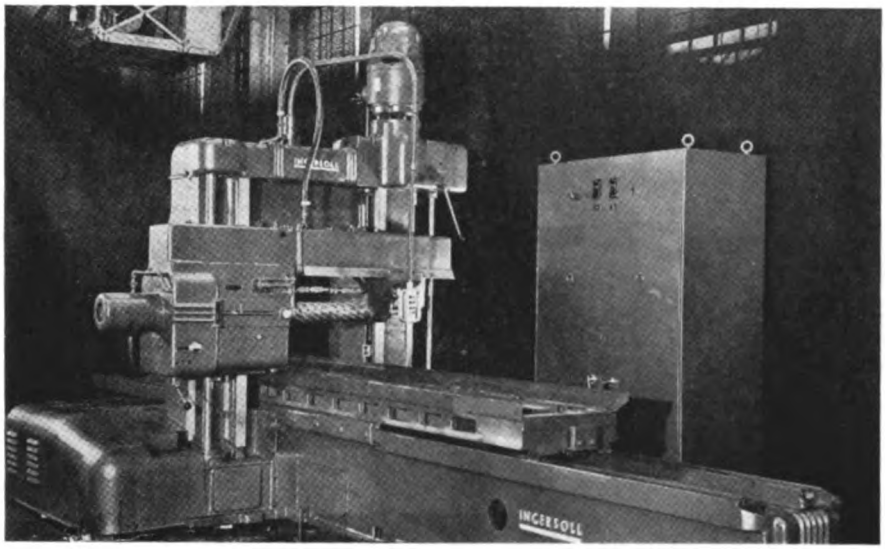
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Organized to achieve:
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Uniform Inspection
Uniform Product

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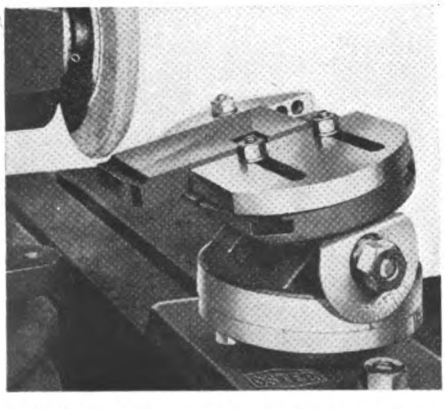


Link motion parts are readily worked on this horizontal spindle machine

head and table feeds in any ratio. The machine is equipped with push-button pendant control which permits speeding up or slowing down of the motors to assist in following scribed lines or templates. An over-arm extends across the table and mounts on the opposite housing. Large slabbing cutters and arbors are held in the arbor support and are adjustable along the over-arm. Ingersoll Milling Machine Company, Rockford, Ill., is the builder.

Universal Fixture For Grinding Dies

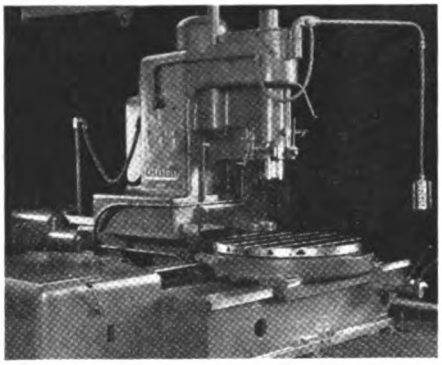
The grinding of all sizes, makes and types of dies and chasers is speeded by the use of a universal fixture built by the Oster Manufacturing Company, Cleveland (3), Ohio, for mounting on the table of any conventional tool and cutter grinding machine. The device is so constructed that it can be adjusted to provide for any throat or rake angle desired. The fixture is said to effect a considerable saving in the cost of dies and chasers ruined by the use of less exact methods of reclamation.



Adjustable fixture which provides any throat or rake angle when grinding dies

Adjustable Rotary Machine for Rod Work

An adjustable rotary machine for rod ending, channeling, trepanning, jaw and tongue milling and all contour milling operations



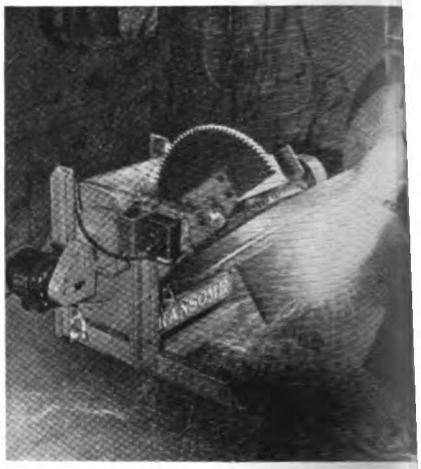
Rod milling machine with push-button control of table and head feeds

on locomotive rods is furnished by the Ingersoll Milling Machine Company, Rockford, Ill. Improvements which have been made in this machine include separate feed motors for the table and head which are controlled from a pushbutton pendant. By pushing a button, the feed to either is gradually increased or decreased as needed when following layout lines on various rod contours. Special fixtures and cutters are also obtainable.

Welding Positioner

Hand and motor-operated welding positioners of 500 lb. capacity have been designed by the Ransome Machinery Company, Dunellen, N. J. The work table has a tilting range of 135 deg. from the horizontal which permits downhand welding in all positions. Motorized units have a variable-speed drive providing a spe range up to one revolution per minute.

The table top is 26 in. in diameter a is T-slotted to aid in clamping work pie to it. All gears are of the cut-tooth ty The machines are furnished with either

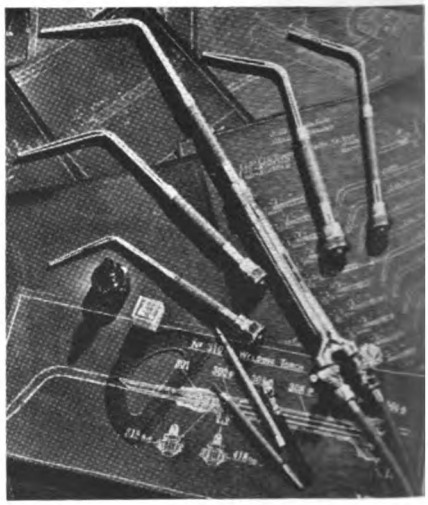


Welding positioner adaptable for work weighing up to 500 lb.

regular base for bench work or with a sub-base which is adjustable to between 27 in. and 42 in. from floor to table top.

Welding Torch Nozzles

Initially produced for aircraft welding Victor Airadiator welding-torch nozzles are now available in all sizes and for all model



Victory welding torches are obtainable in a variety of sizes

of the Victor welding torches. These noz zles are said to have proven very successfu in limiting overheating and are recom mended particularly for heavy brazing op erations or welding in confined spaces wher tip and nozzle overheating causes difficulties The Victor Equipment Company, San Fran cisco (7), Calif., are the manufacturers

(*Turn to next left-hand page*)

LIMA LOCOMOTIVES PLAY THEIR PART

in helping the C. & O. to move more coal



While the operating records of the Chesapeake & Ohio show that miles per serviceable freight locomotive increased by 5.4% in 1942 over the excellent showing of 1941, revenue ton-miles stepped up by 13.3%—an even clearer indication of the heavier service performed by C. & O. freight locomotives during each mile of their increased daily rounds.

A substantial part of this increased load was carried for the C. & O. by Lima-built locomotives, including the "Allegheny Type" 2-6-6-6 articulated superpower Lima steam locomotives. Twenty of these were recently delivered by Lima to the C. & O., and ten more are now being built for this railroad by the Lima Locomotive Works.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**

High Spots in

Railway Affairs...

Railroaders Commended

J. J. Pelley, president of the Association of American Railroads, recently received a joint official expression from Robert P. Patterson, Under-Secretary of War, and James Forrestal, Under-Secretary of the Navy, expressing appreciation to the men and women who work on American railroads, for the splendid job they are doing. "Since the outbreak of the war," says this letter, "the railroads have hauled 76 million carloads of freight, most of it destined for battle fronts. Millions of fighting men have been transported to training camps and embarkation ports. The Army and Navy realize that, to perform this big job, crews on trains, in shops, in yards, and along rights-of-way have had to work long and hard. To the men and women who have made this record movement of men and weapons possible, the Army and Navy are deeply grateful. Keep up the good work—for railroad work is war work, railroad service is vital to victory."

Freight Loss and Damage Increases

It is only natural that the loss and damage to freight should increase with the growing war traffic, coupled with the manpower shortage and the siphoning off of trained railroad workers into the war services. It is unfortunate, however, that these losses should increase when the war and civilian demands are so great for all types of materials and commodities. For the first six months of this year the loss and damage claims paid by the railroads amounted to $18,744,123, as compared to $15,572,717 for the same period of 1942. This is an increase of 20.4 per cent, or almost the same as the percentage increase of revenue tons of freight carried for one mile, for the same period.

Hospital Cars

The Pullman Company is completing the conversion of an order of cars for the Medical Department of the Army. Pullman sleeping, parlor and lounge cars have been converted into air-conditioned traveling hospitals, each with a capacity of about 30 patients. Fifty-eight of the cars are each equipped with 32 folding-type beds in two tiers. They may be folded against the wall for car cleaning and renovating purposes and may be also converted into seats for the daytime use of convalescent patients. These cars have washrooms, toilets and a receiving room, with a special loading door for stretcher cases. Twenty-eight of the cars have 15 double-deck beds, with a capacity of 30 patients. The receiving rooms of these cars are equipped with operating tables, sterilizers, instrument cabinets and medical washstands. Two cars, known as "unit cars", are equipped with large kitchens, personnel quarters, dispensaries, offices and dressing rooms, with facilities for emergency operations.

Lt. Col. Okie Again Honored

Lt. Col. Frederick W. Okie, former division superintendent of the Southern at Birmingham, Ala., commanding the 727th Railway Operating Battalion, which has rendered brilliant service in the North African and Sicilian campaigns, has been awarded the Soldiers' Medal for extraordinary heroism, not in action. He had formerly received the Legion of Merit Medal for personal valor, as noted in the *Railway Mechanical Engineer* of September, 1943, page 440. The new medal is the result of his action when fire broke out in a captured railroad freight station, full of enemy ammunition, incendiary grenades and other explosives. "With utter disregard for his personal safety," the citation stated, "Colonel Okie supervised and assisted in coupling and removing cars of American ammunition, rations and bridge material, from which shells were exploding in all directions. His actions, even though in danger of death or injury from flying fragments, resulted in the saving of much badly needed supplies, and prevented serious damage to vital railroad facilities."

What the Public Thinks About Transportation Agencies

Each year, for the past three, the Opinion Research Corporation of Princeton, N. J., has reported on the state of public opinion toward the railroads. It is of special interest to note the appraisal of the different agencies of transportation, on the basis of the importance of their contribution to the war effort:

	July 1941	July 1942	July 1943
Railroads most important, per cent..	68	83	90
Trucks most important, per cent....	22	13	8
Barges most important, per cent....	10	4	2

Only five per cent of those questioned expect government ownership of the railroads following the war. A rather disturbing tendency noted by the research workers who made the survey was the fact that 39 per cent of those questioned this year, who were critical of railroad employees, cited rudeness as their cause of complaint, as compared to only 16 per cent last year. It was also found that young people are the least appreciative of railroad performance and are the most critical of railroad policies.

Military Railroad Men

The New York Times recently had this to say of the performance of our Railway Operating Battalions: "Among the prizes of the Sicilian campaign were some 300 locomotives and 3,000 cars, two-thirds of them in good order. Among these were a large number of new German cars. Brigadier General Gray, director general of the Military Railway Service, said the other day that British and American railway men were operating 420 miles of track the third day after the first landings. Yesterday (September 27) a dispatch from North Africa told that the American Army's 'crack 727th Railway Operating Battalion' had been cited by General Patton for its skill and swiftness in running Sicilian trains under fire. . . . There is a West Point at Fort Slocum (N. Y.) where dispatchers, engineers and machinists are trained to be officers. It would be ungrateful to forget such officers and the men they command. Their service isn't showy, but it is indispensable."

Train Accidents and High-Speed Operations

Joseph B. Eastman, director of the Office of Defense Transportation, reported to the New England Shippers' Advisory Board at Boston, Mass., on October 6, on "the state of the nation, so far as railroad transportation is concerned". In the course of his address he said, "It is undoubtedly true that with the present tremendous volume of traffic and the high pressure under which the railroads are operating, the accident rate has somewhat increased. But nothing within my knowledge leads me to believe that any state of negligence or carelessness has yet developed on the part of either the managements or the men, or that the equipment is not generally being maintained in condition for safe operation." He referred to the fact that as a result of his request, the railroads had make a check of their passenger train running time in the latter part of 1942. This resulted in a considerable number of schedule changes, all of which resulted in slower running times. The matter is now being re-examined. "It is not a matter which can be dealt with arbitrarily or peremptorily," said Mr. Eastman, "for the changing of railroad schedules is full of complications. . . . Railroad travel may still be regarded as safe, and certainly far safer than highway traffic."

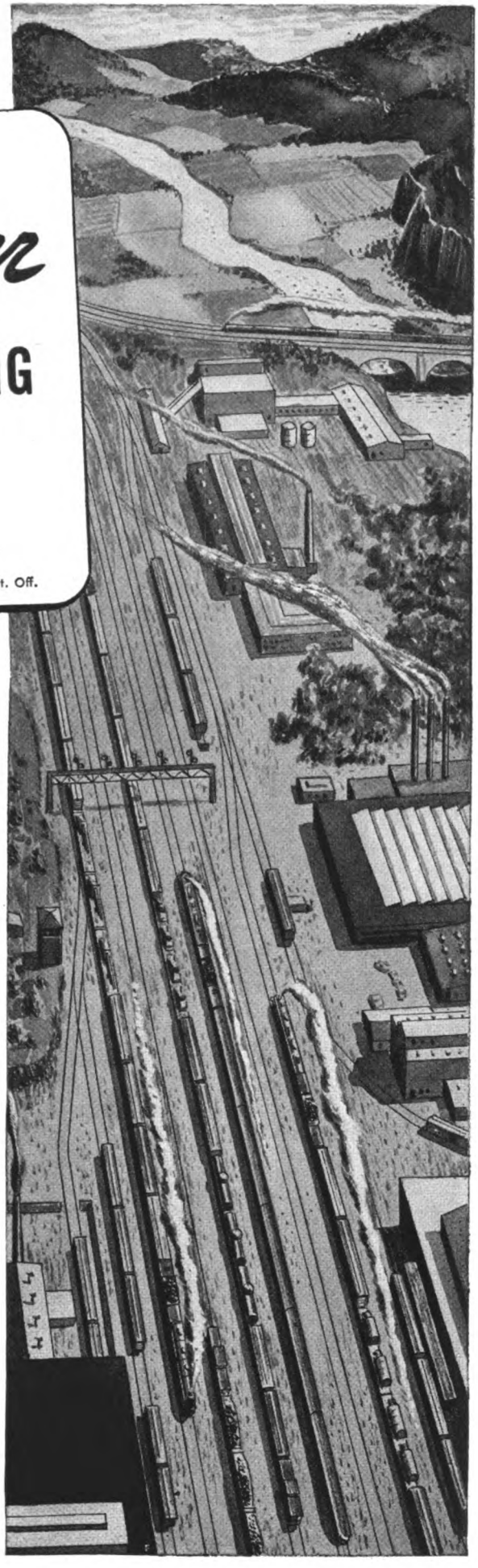
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Booster Power

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The Booster* gets heavy trains in and out of sidings in half the time. Its added power gets you out of any tight spot.

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NEWS

Advanced Car Authorizations Aid in Planning Production Schedules

THE Office of Defense Transportation is reported to have drawn upon authorized advanced allotments of steel for the first six months of 1944 to release 8,467 new freight cars, of which 5,762 were authorized for building out of steel allotted for the first quarter of next year and 2,705 out of steel allotments for the second quarter. Additional cars will be scheduled upon additional authorization being received for materials for this period, both from the current backlog of cars on order but not yet authorized for building and from a number of new orders now pending.

The practice of allocating new car construction in advance from future materials' allotments under the War Production Board's controlled materials plan is designed to aid car-building plants in planning production schedules and also to hold down the accumulation of a large backlog of unauthorized orders. Breakdown of the 8,467 cars newly released by railroads, number, type and builder is shown in the accompanying table. The authorizations for the building of the majority of these cars have previously been reported individually from time to time in these columns.

Most of the 5,762 cars released for the first quarter, 1944, or 3,052, are scheduled for construction in railroad shops, including 800 box, 1,800 hopper, and 350 gondola cars, and 102 cabooses. The remaining 2,710 to be built by contract car builders include 500 box, 1,350 hopper, 625 gondola and 200 flat cars and 35 cabooses. The 2,705 authorized from second quarter materials comprise 800 hopper and 1,000 gondola cars on order with contract builders and 255 box, 600 hopper and 50 gondola cars on order with the railroads' own shops.

With the new releases, the backlog of cars authorized for building now totals 30,500, including 100 automobile, 6,802 box, 16,893 hopper, 4,416 gondola, 1,548 flat, 216 tank, 225 caboose and 300 refrigerator cars, of which about 19,700 are scheduled in contract car building plants and 10,800 in railroad shops. This backlog is made up of about 6,000 cars remaining to be shipped of the War Production Board's 20,000 car-program for the first six months of 1943, 5,900 authorized for building from third quarter, 1943 materials, 10,100 from fourth quarter, 1943 materials and the approximately 8,500 from first half, 1944 materials.

The number of these cars that will be delivered by the year-end depends on how much material is made available. There is a natural time-lag before allotted materials arrive at car-building plants and can be converted into completed cars. It is expected that all or most of the 10,100 cars authorized for the fourth quarter of this year, and probably some third quarter cars, will be carried over for delivery in 1944. The year-end backlog would thus comprise these 10,100 or more cars, the 8,467 already authorized for the first six months of 1944 and such additional authorizations as are subsequently made, and will include cars scheduled for delivery as far in advance as the third quarter of 1944.

There remain about 11,100 cars on order not yet released for building of which 8,400 are on car-builders' books and 2,700 with railroad shops. Among the larger of these placements are the Atlantic Coast Line's order for 1,100 box cars with the Pullman-Standard Car Manufacturing Corporation; the Baltimore & Ohio order for 1,000 box cars with the General American Transportation Corporation and 1,000 hopper cars with the Bethlehem Steel Company; the Chicago & North Western order for 500 ore cars with Bethlehem; the Reading's order for 1,000 gondola cars with the railroad's own shops; and the Southern's orders for 1,052 hopper cars with the Pullman-Standard and 550 box and 400 automobile cars with the Mount Vernon Car Mfg. Co.

Journal Failure Cause of Congressional Ltd. Derailment

THE direct cause of the derailment of the advance section of the Pennsylvania's "Congressional Limited" within the corporate limits of Philadelphia, Pa., on September 6 was, according to the report of the Interstate Commerce Commission, a broken journal on the seventh car of the 16-car train. The then available data indicated that the accident resulted in the death of 78 passengers and 1 dining car employee and in the injury of 102 passengers, 5 Pullman employees and 22 dining car employees.

The immediate cause of the derailment was the failure of the left front journal of the front truck of the seventh car, P. R. R. 1860. After the accident it was found that this journal was broken off, the fracture varying from 7¼ to 7⅞ in. inward from the collar. The end of the journal remaining attached to the wheel assembly was ground down to an oval shape by contact with the journal wedge, but there was no evidence of cutting on the outer portion. The journal box was demolished, but a portion of the outer end of the bearing was recovered. It showed no lining metal remaining on the bearing surface.

When examined 1½ hr. after the accident the journal was heated considerably above normal running heat, the report discloses. Furthermore, tests and analyses of the journal and bearing indicated that the journal had been heated to a temperature of at least 900 deg. and its surface temperature had reached some 1,400 deg. The shallowness of the structural change resulting from this high temperature indicated that the heating occurred very rapidly, the report says further, basing this observation on the report of the road's engineer of tests. The metal of the journal and bearing were found to meet Association of American Railroads specifications.

Coach 1860 was built in 1909 and modernized in 1935, the report adds. It was of conventional all steel, plate-girder, post

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New Freight Car Authorizations by War Production Board

Allocated from First Quarter, 1944 Materials

Name of Railroad	No.	Type	Builder
Alton	250	Hopper	American Car & Foundry
	250	Gondola	General American
Atchison, Topeka & Santa Fe	400	Hopper	American Car & Foundry
	50	Caboose	Company Shops
Central of New Jersey	500	Hopper	Pressed Steel Car
Chicago, Burlington & Quincy	400	Hopper	Company Shops
Chicago, Milwaukee, St. Paul & Pacific	100	Hopper	Company Shops
Detroit, Toledo & Ironton	100	Gondola	Greenville Steel Car
Great Northern	300	Box	Company Shops
Gulf, Mobile & Ohio	125	Gondola	American Car & Foundry
Illinois Central	300	Hopper	Company Shops
Lehigh Valley	15	Caboose	Company Shops
New York Central	400	Box	Company Shops
New York, Chicago & St. Louis	300	Box	General American
	50	Gondola	Greenville Steel Car
New York, New Haven & Hartford	100	Flat	Greenville Steel Car
Pere Marquette	100	Gondola	Greenville Steel Car
	100	Flat	Greenville Steel Car
Reading	25	Caboose	Company Shops
	600	Hopper	Company Shops
St. Louis-San Francisco	150	Gondola	Company Shops
Seaboard Air Line	200	Box	Pullman-Standard
	200	Hopper	Pullman-Standard
Terminal R. R. of St. Louis	35	Caboose	Mount Vernon Car
Virginian	400	Hopper	Company Shops
Wabash	100	Box	Company Shops
	12	Caboose	Company Shops
	200	Gondola	Company Shops

Allocated from Second Quarter, 1944 Materials

Central of New Jersey	1,000	Gondola	Bethlehem Steel
Lehigh Valley	300	Hopper	Bethlehem Steel
New York, Chicago & St. Louis	500	Hopper	American Car & Foundry
Reading	600	Hopper	Company Shops
Wabash	255	Box	Company Shops
	50	Gondola	Company Shops

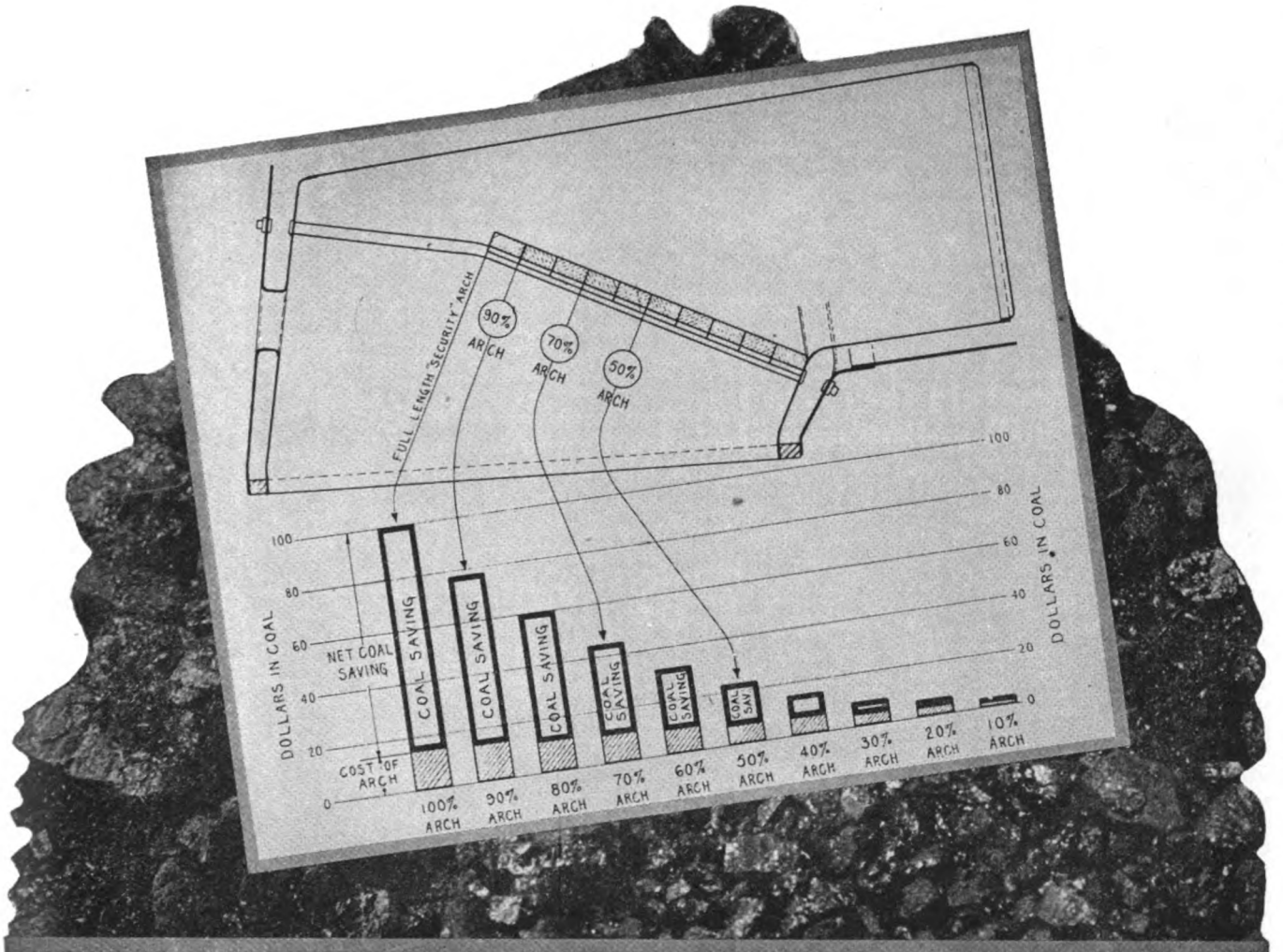
KEEP FUEL-BURNING EFFICIENCY AT A MAXIMUM

Every railroad man is conscious of the wartime importance of each pound of coal.

To make it yield its utmost in steam production is imperative. This is one of the functions of the Security Sectional Arch.

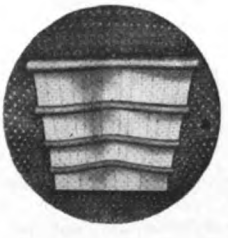
But only a complete arch can achieve the maximum in results. Hence the importance of having full length arches in all locomotives.

This is one sure way of stepping up fuel-burning efficiency.



HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists



AMERICAN ARCH CO.
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60 EAST 42nd STREET, NEW YORK, N. Y.

Locomotive Combustion Specialists

and sill construction. Class 2B repairs were made in June, 1941. The front wheels of the front truck were mounted on the axle in 1937. The wheels and axle were applied to the car and the journals were repacked June 16, 1943. The car was equipped with four-wheel trucks, with 5½-by 10-in. journals and one-piece cast-steel side frames.

The accident occurred at 6.06 p. m. on the Pennsylvania's four-track main line at a point 150.9 ft. east of a signal tower known as Shore, Pa., which is 2.9 miles east of the North Philadelphia passenger station. In addition to the four main tracks, the line at that point is paralleled on each side by a secondary track. The train was traveling on track No. 1, the eastward passenger track, and the derailment occurred at the west frog of a movable-point crossing where a crossover (from track No. 2 to the southerly secondary track) intersects track No. 1. The rails and ties bore flange marks for about 72 ft. beyond the heel of the west frog of the movable-point crossing, and the track was torn up for 480 ft. and damaged for an additional 1,056 ft. beyond the flange marks.

The train was moving at a speed of 56 m.p.h. in territory where the authorized speed is 70 m.p.h., and had received a proceed indication from the eastward signal at Shore.

Designated as Passenger Extra 4930 East, the train consisted of electric locomotive No. 4930 and 8 coaches, 2 dining cars, and 6 Pullman parlor cars, in the order named. These cars were all of steel construction. The train left Washington, D. C., at 4 p. m. and made no stops in the 2 hr. 6 min. run of 141.4 miles to the point of the accident, as the schedule for the regularly-operated advance section of this train calls for no passenger stops between the initial terminal and Newark, N. J.

The engine and the first six cars, still coupled, stopped with the front end of the engine 2,198 ft. east of the point of the accident. The rear truck of the sixth car became detached and came to a stop on the roadbed adjacent to track No. 1, 740 ft. east of the point of derailment. The seventh to the fourteenth cars, inclusive, and the front truck of the fifteenth car, were derailed. The seventh and eighth cars were demolished and the ninth to twelfth cars, inclusive, were badly damaged. The thirteenth and fourteenth cars were slightly damaged.

Most of the fatalities occurred in the seventh and eighth cars. The seventh car struck the south A-frame supporting the westward signal bridge with sufficient force to shear it from the concrete foundation and move it 22 ft. eastward. The car was sheared for almost its whole length diagonally from the floor on the right side to the junction of the roof and side sheets on the left side, and came to rest with the rear end jammed against the A-frame. The eighth car stopped on its right side on top of the rear end of the seventh car, with the center of its roof against the A-frame. The superstructure was crushed inward and the center sills were bent. The ninth to the twelfth cars came to rest practically upright in various positions across the main tracks. The thirteenth and fourteenth cars remained upright and practically in line with the track. The rear truck of the fifteenth car, and the sixteenth car, remained on the rails.

The commission's investigation developed that members of the crew of the train involved made frequent observations of the equipment between Washington and Shore without observing evidence of an overheated journal. The members of the crews of four eastbound and two westbound freight trains, operators at fifteen points, and mechanical forces at Baltimore, Md., Wilmington, Del., and Philadelphia (Thirtieth Street) and North Philadelphia, also observed the equipment of the train as it passed them and saw no defective condition. The crew of a yard engine standing about 1 mile west of Shore observed fire and smoke from the left side of Passenger Extra 4930 as it was passing, about 1 min. before the accident occurred, and telephoned that fact to the operator at the Shore interlocking tower, but the engine had passed that tower before the operator could take any action to stop the train.

The report disclosed that the mileage accumulated by coach 1860 in a period of 82 days prior to the day of the accident was about 30,000 miles. During this time the car had been used regularly in passenger service between Washington and New York and other points. On the day of the accident it had run from New York to Washington in the train arriving at that terminal about 11:20 a.m., and during that run no defective condition had been observed. During a layover of about 4½ hr. in Washington the journal boxes were supplied with oil and inspected, but no defect was observed.

No recommendation of any change in the road's rules or operating practices is made by the Commission in its report, nor is the accident, even indirectly, attributed to any individual's error or neglect.

Report Shows Low Water Cause of "Century" Accident

THE immediate cause of the explosion of the boiler of the locomotive hauling the eastbound Twentieth Century Limited on the morning of September 7, which derailed that train east of Canastota, N. Y., was overheating of the crown sheet due to low water, according to the report of the Interstate Commerce Commission, issued October 1. In this accident 11 of the 17 streamline passenger-train cars of which the train consisted were derailed. The engineman, fireman, and a traveling fireman were killed, and 9 mail clerks, 5 Pullman porters, a chef, 3 cooks, and 11 dining-car waiters were seriously injured.

The train left Syracuse, N. Y., at 4:13 a. m., 18 min. late, and had proceeded 22 miles to a point 1.4 miles east of Canastota, N. Y., when the boiler exploded at 4:35 a. m. while the train was moving at an estimated speed of 70 miles an hour. (The Valve-Pilot could not be found.) The boiler was torn loose from the running gear, all rivets in the smokebox connection were sheared, and it came to rest 900 ft. forward from the point of the explosion, headed in the opposite direction, nearly upright, and 35 ft. south of the track, which at the scene of the accident is straight and approximately level. Both rails were depressed 2 in. at the point of the explosion. The superheater units remained attached to the header in the smokebox. The running gear and tender, all wheels of which were derailed, came to rest 1,300 ft. from the point of explosion. Parts of the wreckage, including the locomotive cab, the streamline nose, headlight, smokebox door, and the brake valves and pedestal, were scattered in all directions within a radius of 500 ft. The firebox crown sheet, with the upper part of the door sheet and parts of both side sheets attached, was found turned inside out, to the right of the track about 400 ft. forward from the point of the explosion. Many of the appurtenances were broken from the boiler and many parts apparently buried.

The locomotive, No. 5450, was a 4-6-4 type of the J-3a class, which had received a new tender of the tender-bed type, with a capacity of 17,500 gals. of water and 43 tons of coal, on August 18, 1943. At the time of the accident the locomotive had made 17,558 miles since the last shopping. The boiler was equipped with a low-water alarm.

Examination of the boiler following the accident showed that about 19 sq. ft. of the crown sheet had been overheated in a triangular area, the base of which extended between the fourth and fifth longitudinal rows of stays on each side of the center at the front end and tapered irregularly back to the thirtieth transverse row from the flue sheet. The line of demarcation of this area, which was of a distinct blue color, showed the water level to have been about 3½ in. below the highest point of the crown sheet.

On this run the locomotive had hauled train No. 26 from Chicago with changes of crew at Elkhart, Ind.; Toledo, Ohio; Collinwood; Buffalo, N. Y., and Syracuse. The evidence brought out in the investigation, conducted by the Bureau of Locomotive Inspection, Interstate Commerce Commission, disclosed no unusual circumstances until after the train had departed from Buffalo. While operating at reduced speed on yellow block signals between Buffalo and Depew, N. Y., the fireman reported that the extension operating rod which controlled the throttle of the centrifugal feedwater pump became disconnected. The locomotive was operated to Rochester, N. Y., using the injector to supplement the feedwater pump. While standing at a red block signal at Rochester the extension rod was again connected. After leaving Rochester the rod again became disconnected, but this time the throttle was open wide enough so that the pump supplied the boiler without assistance from the injector. A further attempt was made to repair the connection between the extension rod and the valve stem at the Waynesport coaling plant, but the connection again separated shortly after leaving that point. The fireman

(*Continued on next left-hand page*)

LOCOMOTIVE BOILERS

"The sustained hauling capacity of a steam locomotive depends primarily on the ability of the boiler to provide the necessary steam . . ."

—THE RAILWAY GAZETTE

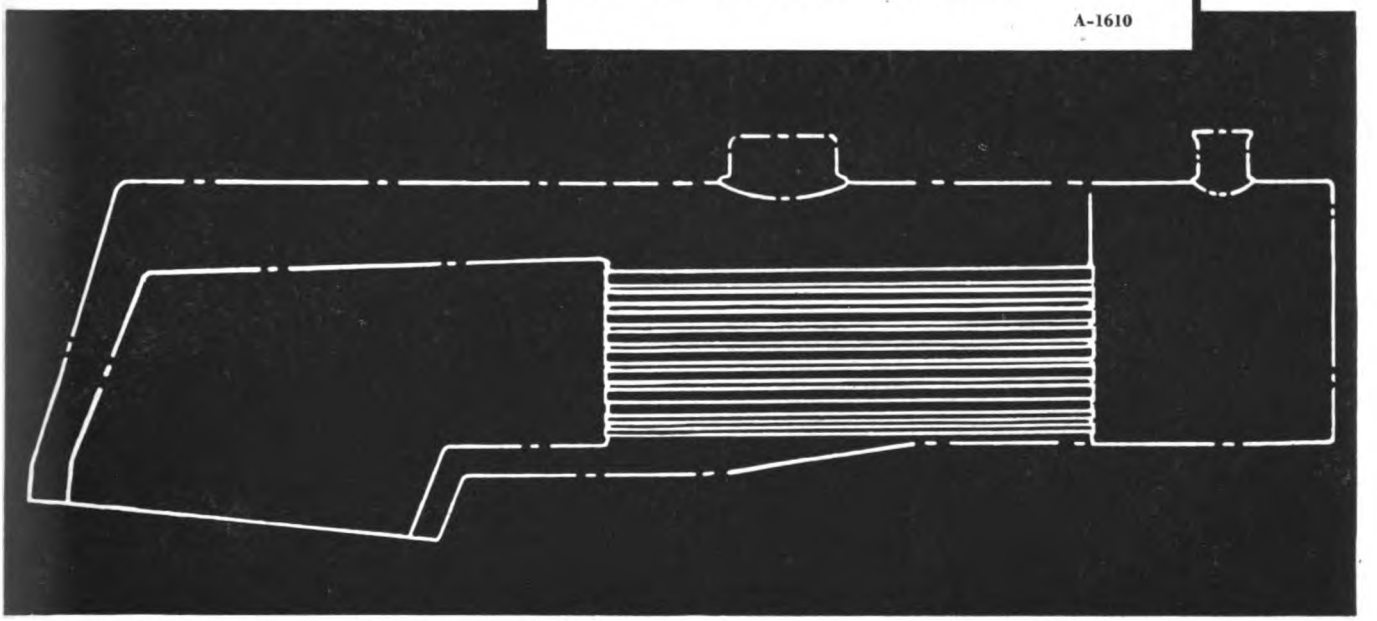
• • •

ELESCO

Ample boiler capacity results in low boiler maintenance.

Maximum boiler capacity for any given locomotive is obtained with the small-flue type and Elesco superheater.

A-1610



SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

THE SUPERHEATER COMPANY

Representative of
AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
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• • •

Montreal, Canada
THE SUPERHEATER COMPANY, LTD.

however, opened the pump throttle to a point wide enough to over-supply the boiler and the water supply was controlled by stopping and restarting the pump with the over-speed trip mechanism. At Syracuse the situation was explained to the engineman, fireman, and traveling fireman who were to take the train east from Syracuse by the engineman, fireman and traveling fireman who brought the train in from Buffalo. These men decided to go on with the locomotive, leaving the relief locomotive which had been called for by the incoming engineman en route.

In discussing the evidence the report points out that "the positions of the injector steam valve, the feedwater pump throttle or operating valve, the feedwater pump reset device at the time of the explosion could not be determined because of the ensuing damage. All persons on the locomotive were killed and, therefore, no information as to the maintenance of the water level after the locomotive departed from Syracuse could be obtained. Judging by the results of boiler explosions investigated by our Bureau of Locomotive Inspection where crown sheets were equipped with protective devices, the effects of the accidents were slight as compared with the complete destruction of the boiler as occurred here. It is obvious that this explosion would not have been so violent if the locomotive had been so equipped." The report concludes with the recommendation "that the New York Central provide crown-sheet protection in case of low water by installing suitable devices for that purpose."

White Heads WPB Equipment Division

LYNNE L. WHITE, chief operating officer of the Chicago & North Western, has been appointed director of the Transportation Equipment Division, War Production Board, succeeding Andrew Stevenson, who has been made executive assistant to Hiland G. Batcheller, the WPB's operations vice-chairman.

Next Six Months Critical, Says Eastman

IN a report "on the state of the nation, so far as railroad transportation is concerned," Joseph B. Eastman, director of the Office of Defense Transportation, in an address October 6 before the New England Shippers Advisory Board at Boston, Mass., warned that, for several reasons, "the next six months will be a critical period in railroad performance."

Saying that he believed that the railroads, with the help of their customers and employees, will be able to maintain their record of superlative performance until they are "over the hump," Mr. Eastman appealed to his listeners to give the "few ounces of help in reserve" that should put the carriers "over the top" in this critical period immediately ahead.

Among the reasons that the immediate future is so critical, according to the ODT director, are: Equipment shortages, growing pressure on the roads that serve the Pacific coast, the advent of winter, diminishing aid from trucks and buses, manpower shortages, featherbed rules, and the effect of recent accidents.

A. S. M. E. Annual Meeting

A HEAVY program is scheduled for the annual meeting of the American Society of Mechanical Engineers to be held at the Hotel Pennsylvania, New York, November 29 to December 2, inclusive. The Railroad Division will hold two sessions on Thursday, December 2, and will also participate in a session with the Oil and Gas Power Division and the Land Transportation Committee of the American Institute of Electrical Engineers on Wednesday afternoon, December 1. The program for these and other sessions of general interest are as follows:

TUESDAY, NOVEMBER 30
9:30 a. m.

Metal Cutting Research (I)

Elements to be Considered in Milling Steel with Cemented Carbide-Tipped Milling Cutters, by Fred W. Lucht, development engineer, The Carboloy Company.

Standardization of Tool Life for Evaluating the Machinability of Single Point Tools, Cutting Fluids, or Materials Cut, by O. W. Boston, University of Michigan.

2 p. m.

Chip Control

Symposium:

Increasing Tool Life by Better Tool Finishing, by V. H. Ericson, The Norton Company.

Chip Control with Sintered Carbide Tools, by M. F. Judkins, Firthite Division, Firth-Sterling Steel Company.

Standardization of Chip-Breaker Type of Fine-Finished Single-Point Cutting Tools, by Carl J. Wiberg, production engineering department, Wright Aeronautical Corporation.

The Practical Aspects of Chip Control, by Frank J. Oliver, The Iron Age.

New Principles in the Design, Generation, and Maintenance of Cutting Tools, with a demonstration of the Bura-way grinder for grinding single-point tools, by Walter M. Bura, The James Donaldson Co., Inc.

Metal Cutting Research (II)

Practical Cutting Fluid Recommendations for Use with High-Speed-Steel Tools, by O. W. Boston, University of Michigan; H. L. Moore, Pure Oil Company; E. M. Slaughter, Republic Steel Company, and W. H. Oldacre, D. A. Stuart & Company.

Metal-Cutting Nomograph for Cutting Steel with Single-Point Tools, by W. W. Gilbert and W. C. Truckenmiller, University of Michigan.

WEDNESDAY, DECEMBER 1
2 p. m.

Oil and Gas-Power—Railroad—Land Transportation Committee, A. I. E. E.

Factors Involved in the Selection of Railroad Motive Power, by Brig. Gen. C. D. Young, deputy director, Office of Defense Transportation.

7 p. m.

Annual dinner.

THURSDAY, DECEMBER 2
9:30 a. m.

Plastics

Creep Properties of Molded Phenolic Plastics, by David Telfair, T. S. Carswell, and H. K. Nason, Plastics Division, Monsanto Chemical Company.

Plastic Printing Plates, by William R. McLain.

Anti-scatter Treatments for Glass, by Frank W. Reinhart, Ruth Kronstadt, and Gordon M. Kline, National Bureau of Standards.

Railroad (I)

Possibilities of New Materials To Be Used in Railroad Equipment in the Postwar Period, by C. B. Bryant, engineer of tests, Southern Railway.

Passenger Cars for the Postwar Period, by Edward G. Budd, Edward G. Budd Manufacturing Company.

Report of the Committee on Survey, RR-6, by E. G. Young, professor, railway mechanical engineering, University of Illinois.

Report of the Standing Technical Committee—Locomotives, by Lawford H. Fry, director of research, Locomotive Institute.

Report of the Standing Technical Committee—Cars, by K. F. Nystrom, mechanical assistant to vice-president, Chicago, Milwaukee, St. Paul & Pacific.

12:30 p. m.

Railroad Luncheon.

2 p. m.

Railroad (II)

Research Possibilities in Railroad Equipment, by W. I. Cantley, mechanical engineer, Association of American Railroads.

Education of Railway Mechanical Engineers for the Postwar Period, by Roy V. Wright, editor, *Railway Mechanical Engineer.*

Orders and Inquiries for New Equipment Placed Since the Closing of the October Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Loco.	Builder
Southern Pacific	19	1,000 hp. Diesel-elec.	Baldwin Loco. Works

LOCOMOTIVE INQUIRIES

Road	No. of Locos.	Type of Loco.	Builder
Tennessee Central	4	2-8-4 or 2-8-2	

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Baltimore & Ohio	1,000[1]	50-ton composite hopper	Bethlehem Steel Co.
Bethlehem Steel Co.	100	50-ton gondola	Co. shops
Central of New Jersey	1,000	70-ton composite gondola	Bethlehem Steel Co.
	500	50-ton composite hopper	Pressed Steel Car Co.
	100	70-ton flat	Pressed Steel Car Co.
Chicago, Burlington & Quincy	170	Box[2]	Co. shops
	175	Automobile[2]	Co. shops
Delaware & Hudson	100	50-ton all-steel gondola	Bethlehem Steel Co.
	100	50-ton all-steel hopper	Bethlehem Steel Co.
New York, New Haven & Hartford	100[3]	70-ton flat	Greenville Steel Car Co.
St. Louis-South Western	150[3]	150 gondola	Co. shops
Southern Pacific	200[4]	50-ton gondola	Pressed Steel Car Co.
	300[4]	50-ton gondola	Mt. Vernon Car Mfg.

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
Grand Trunk Western	300	70-ton gondola	.....
Missouri Pacific Lines:			
Missouri Pacific	500[5]	70-ton hopper	.....
N. O. T. & M.	200[5]	70-ton hopper	.....
Int. Grt. Nor.	100[5]	40-ton stock	.....

[1] Subject to WPB approval.

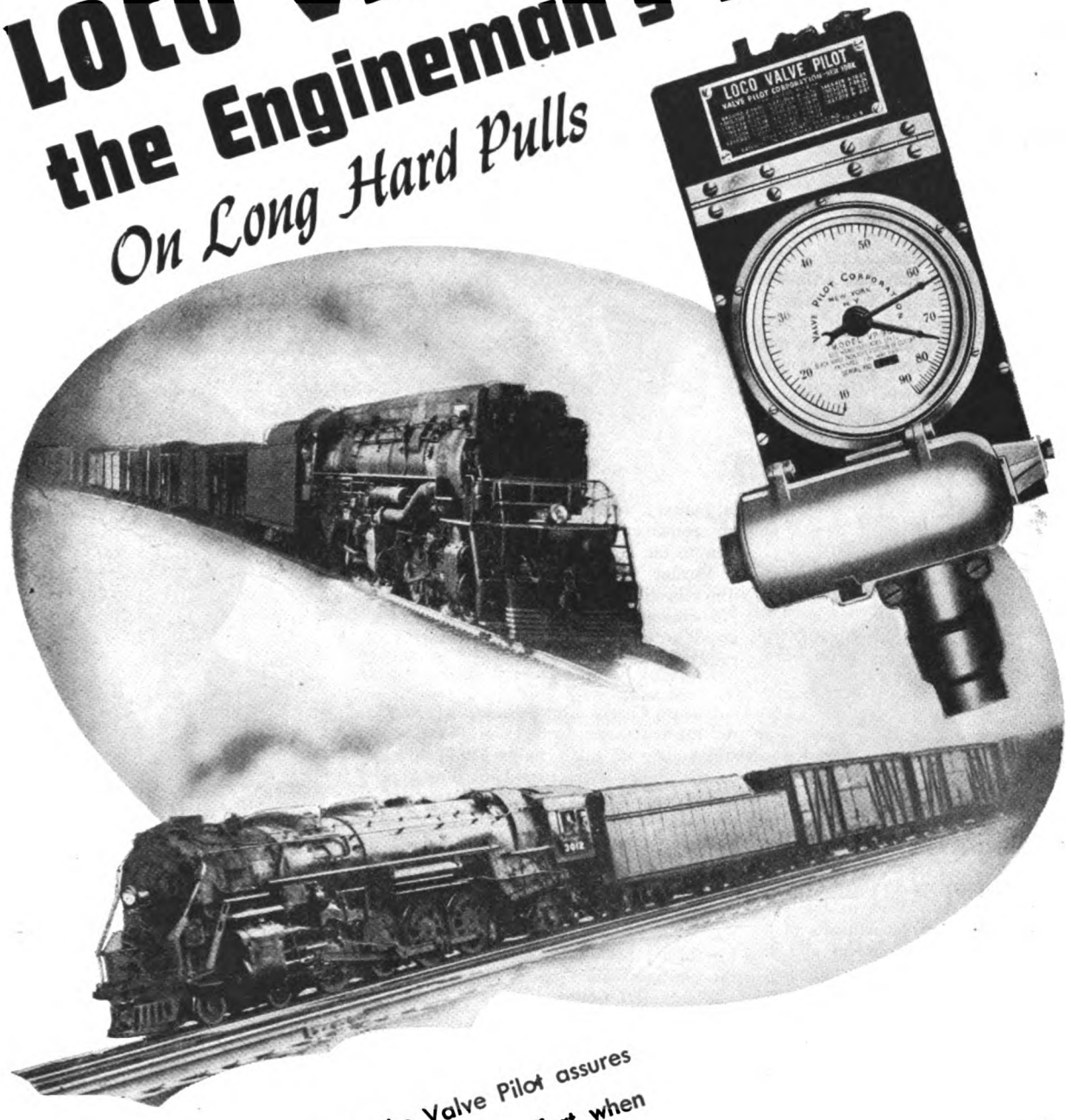
[2] Unconfirmed.

[3] Unconfirmed; subject to WPB approval.

[4] Total cost of 500 cars $1,760,000. Deliveries scheduled for second and third quarters of 1944.

[5] Federal court authorization for the purchase of these cars, at total estimated cost of $2,729,000, was received on September 21.

LOCO VALVE PILOT
the Engineman's friend
On Long Hard Pulls



Accurate and positive, the Valve Pilot assures the engineman of maximum tractive effort when needed and provides for him and the management a written record of fine performance.

VALVE PILOT CORPORATION

230 Park Avenue, New York 17, N. Y.

Supply Trade Notes

AMERICAN STEEL & WIRE CO.—*E. A. Murray,* supervisor of the Priorities division of the Cleveland general sales office of the American Steel & Wire Co., has been appointed assistant manager of the manufacturers' sales department in the Chicago sales office of this company.

◆

CUTLER-HAMMER, INC.—*C. V. Topliffee* has been appointed manager of the Boston, Mass., district office of Cutler-Hammer, Inc., to succeed *W. E. Addicks* who has been transferred to the New York office as district manager. *P. S. Jones* has been appointed to the position of general sales manager with headquarters at New York.

◆

PEERLESS EQUIPMENT COMPANY.—*Edward Kopper,* vice-president of the Gould Storage Battery Corporation, has resigned to become vice-president of the Peerless Equipment Company, Chicago. Mr. Kopper was born at St. Paul, Minn., on November 27, 1890, and was graduated from the



Edward Kopper

University of Minnesota in 1913. After graduation, he was employed in the engineering and production departments of a number of manufacturing concerns and in 1919 was appointed assistant superintendent of shops of the American Hoist & Derrick Co., St. Paul. Later he established his own business, handling the sales of railway and mill supplies for a number of manufacturers. In 1931, he went with the Gould Storage Battery Corporation as railway sales manager and later was elected vice-president.

William E. Gray, formerly engineer of draft gear tests at the Purdue engineering experiment station, has been elected vice-president in charge of engineering of the Peerless Equipment Company. Mr. Gray was born on October 6, 1896, in Coupon, Pa., and for several years was employed in the engineering department of the Pittsburgh Meter Company. He served on the Mexican border with the 107th Field Artillery of the Pennsylvania National Guard and in World War I. After the war he attended Purdue University, of which he was a graduate in 1923. He then entered the employ of the steam generation department of the Semet-Solvay Company at Ashland, Ky., and in February, 1924, was appointed instructor of mechanical engineering at Purdue University. In November, 1926, Mr. Gray was placed in charge of draft-gear investigations on part time and



William E. Gray

in January, 1927, he resigned as instructor of mechanical engineering to devote full time to the draft-gear investigation. While at Purdue, he was engaged in field work at different times on various projects for the Association of American Railroads and also acted as consultant for manufacturers of railway mechanical equipment.

◆

PHILCO CORPORATION.—*Lionel M. Searle,* for the past year manager of the Monroe street plant of the Simplex Radio division of the Philco Corporation, Sandusky, O., has been appointed manager of the entire division.

◆

ALLEGHENY-LUDLUM STEEL CORPORATION.—*Paul E. Floyd,* who has been on leave of absence in the iron and steel branch of the War Production Board, has resumed his former position as district manager in the Chicago branch office of the Allegheny-Ludlum Steel Corporation.

◆

OLIVER IRON & STEEL COMPANY.—*J. G. Graham,* manager of railway sales for the Oliver Iron & Steel Corporation, has been appointed a member of the rails and accessories industry advisory committee of the War Production Board.

◆

REYNOLDS METAL COMPANY.—*G. S. Goodwin,* who retired after 37 years' service in the mechanical department of the Chicago, Rock Island & Pacific, as announced in the October issue, has become associated with the Reynolds Metals Company, Railway Supply division, Chicago, where he will have charge of designing new car equipment and parts for modernizing locomotives and cars.

BALDWIN LOCOMOTIVE WORKS. — The Baldwin Locomotive Works, Philadelphia, Pa., has opened a new district office at 10 High Street, Boston, Mass., under the managership of *Wilbur H. Whitty.* Mr. Whitty will direct sales in the New England area for all divisions of the company, including the Locomotive and Ordnance Division, Baldwin-Southwark Division, Cramp Brass and Iron Foundries Division, Standard Steel Works Division, Baldwin de La Vergne Sales Corporation, and the Pelton Water Wheel Company. Mr. Whitty was born on November 7, 1894, in Wyandotte, Mich. He attended Georgia School of Technology, Atlanta, Ga., and Lowell Institute, Cambridge, Mass. For a time he was associated with the McDonough Coal Saving Corporation, Detroit, Mich., in an engineering capacity and later was purchasing director of the All America Truck Company, Chicago. In 1923 he became district manager of the Riley Stoker Corporation, Worcester, Mass., and in 1929 founded the Whitty



Wilbur H. Whitty

Manufacturing Company, Inc., Boston, manufacturers of automatic stokers. He was president of the latter company until January, 1942, when he resigned to join the War Production Board as head industrial specialist for New England.

◆

TIMKEN ROLLER BEARING COMPANY.—*Whitley B. Moore,* general manager of sales of the Steel and Tube division of the Timken Roller Bearing Company, Canton, Ohio, has been appointed director of sales of all divisions and has been succeeded by *C. H. McCollam,* assistant general manager of sales of the Steel and Tube division.

Whitley B. Moore, was a graduate of the University of Michigan in 1918 with a degree in mechanical engineering. He served in the Navy during the last war and immediately after the war went with the Timken Company where he worked in the shop engineering department. In 1921 he was sent to the West Coast as Western

(*Continued on next right-hand page*)

division manager; in 1924 he returned to Canton as assistant general manager of the Industrial division, a new department, and in 1934 he became general manager of that division in full charge of all industrial sales. He became general manager of sales, Steel and Tube division, in 1940.

C. H. McCollam was born in Canton and for a few years was employed in the chemical research department of the General Electric Company. He went with Timken in 1918 as a control analyst in the chemical and metallurgical laboratories of the company and in 1925 he became chief chemist. Since 1940 he has been assistant general sales manager of the Steel and Tube division.

◆

GENERAL ELECTRIC COMPANY.—*B. F. Ilsley* has been appointed assistant manager of sales at the newly-formed Oakland, Calif., works section of the General Electric Company's wire and cable division. He was formerly assistant to the manager of the wire and cable division. *J. S. Overstreet*, who has been in charge of wire and cable sales of the company's commercial cable division, has been appointed assistant manager of sales for the cable section at Schenectady, N. Y., and *J. J. Curtin*, of the wire and cable division at Fort Wayne, Ind., has been appointed assistant manager of sales for the magnet wire section in that city.

◆

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.—*Gwilym A. Price*, president of the Peoples-Pittsburgh Trust Company, Pittsburgh, Pa., has been elected a vice president of the Westinghouse Electric & Manufacturing Co.

Thomas I. Phillips, vice-president, has been appointed head of the company's Pittsburgh, Pa., divisions to succeed *A. C. Streamer*, who has been appointed assistant to the president. Mr. Phillips began his career with Westinghouse in 1915 as a tool maker.

◆

WHITING CORPORATION.—*A. J. Brown* has been appointed manager of the Pacific coast branch of the Whiting Corporation, Harvey, Ill., with headquarters in Los Angeles, Calif. Mr. Brown has been an executive of the Whiting Corporation for the past 14 years. Prior thereto he was associated with the Allis-Chalmers Manufacturing Company for 28 years.

◆

SYMINGTON-GOULD CORPORATION.—*W. J. Phillips*, formerly assistant general manager of the Rochester, N. Y., plant of the Symington-Gould Corporation, has been transferred to the company's miscellaneous steel castings sales division in New York.

◆

PEERLESS EQUIPMENT COMPANY.—The Peerless Equipment Company, of Chicago, now represents the *Gould Storage Battery Corporation*, of Depew, N. Y., in the sale of railroad, car-lighting and air-conditioning batteries to all railroads having headquarters in Chicago and the Twin City area. Peerless will also represent the Gould Company in the sale of signal batteries and equipment with northwestern roads. The *Modern Supply Company*, of Chicago, will continue to represent Gould in the sale of signal batteries and equipment with all railroads having headquarters in the Chicago area. *Edward Kopper*, of the Chicago office of the Gould Storage Battery Corporation, and *Harry Matthews*, also associated with Gould in the sale of railroad batteries, have joined the Peerless Equipment Company.

◆

AMERICAN BRAKE SHOE COMPANY.—*M. N. Trainer* has been elected first vice-president of the American Brake Shoe Company. Mr. Trainer has been a vice-president of the American Brake Shoe



M. N. Trainer

Company since 1933, and president of the Brake Shoe and Castings Division since 1939, of which division he will continue as president. Mr. Trainer, a graduate of the University of Pennsylvania in 1910, joined the American Brake Shoe Company in 1916 as a brake-shoe inspector. He went into sales and sales engineering, and in 1926 became vice-president of American Malleables Company and also of American Brake Materials Company. In this latter position Mr. Trainer devoted his attention to the development of brake materials for the automotive industry. After completing this assignment he returned to the sales, production, and improvement of railroad brake shoes.

◆

GLOBE STEEL TUBES COMPANY.—*Thomas R. Coffey* has been appointed manager of sales, Wisconsin-Minnesota district, of the Globe Steel Tubes Company. Mr. Coffey's headquarters are at Milwaukee, Wis.

◆

BIRD-ARCHER COMPANY, LIMITED.—*Hugh C. Harragin*, formerly vice-president and general manager, has been elected president and general manager of the Bird-Archer Company, Limited, Montreal, Que.

◆

COLUMBIA STEEL COMPANY.—*F. B. DeLong*, vice-president in charge of sales in the Los Angeles, Calif., district for the Columbia Steel Company, west coast subsidiary of the United States Steel Corporation, has been appointed vice-president and general manager of sales for the company, to succeed *J. R. Gregory*. Mr. DeLong began his career with the Columbia Steel Company in 1937 as manager of the tubular alloy and stainless department in Los Angeles. He was appointed district manager of sales of the Los Angeles district a few months later and elected vice-president in charge of sales in December, 1939.

◆

GRAYBAR ELECTRIC COMPANY.—*Norman M. White*, service manager at St. Louis, Mo., has been appointed district operating manager at Dallas, Tex., for the Graybar Electric Company. *J. R. Ernest*, assistant to the general service manager, has been appointed district operating manager at St. Louis, and will assume the duties formerly performed by Mr. White. Mr. White joined the Philadelphia, Pa., office of the Graybar Electric Company in 1922 as a stockman. He was appointed service supervisor at Baltimore, Md., in 1926, and service manager at St. Louis in 1940. Mr. Ernest joined the Graybar Company at Chicago in 1924. He was transferred to the company's headquarters as sales statistician in 1940, and later became assistant to the general service manager.

◆

LODGE & SHIPLEY MACHINE TOOL COMPANY.—The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, is planning to convert its plant facilities to the production of Diesel engine parts, aircraft propeller parts and other new types of products as soon as its present backlog of lathe orders is reduced. The work will be carried out under sub-contract for the General Machinery Corporation, Hamilton, Ohio, and the Aero Products Corporation division of the General Motors Corp.

◆

BEATTY MACHINE & MANUFACTURING COMPANY.—*L. C. Beatty*, president of the Beatty Machine & Manufacturing Company, succeeds his father, William R. Beatty, deceased, in the management of that company. L. C. Beatty came with the company after his graduation from Purdue University in 1931.

◆

GRIP NUT COMPANY.—*Ernest H. Weigman* has resigned as vice-president in charge of sales of the Grip Nut Company, Chicago, to establish his own business. *John D. Ristine*, assistant to the president, will handle the sales department of Grip Nut in addition to his other duties.

◆

WINE RAILWAY APPLIANCE COMPANY.—*William F. Cremean*, who has been associated with the Wine Railway Appliance Company for 25 years, has been relieved of his duties as works manager but will continue with the company in a consulting capacity. *N. E. Weiffenbach*, formerly supervisor of the car department for the Wheeling & Lake Erie, has joined the engineering department of the company.

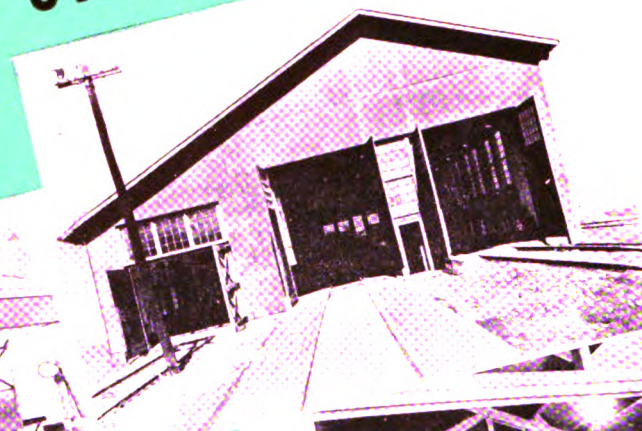
Obituary

WILLIAM R. BEATTY, of the Beatty Machine & Manufacturing Company, Hammond, Ind., died on September 8 at his

(Continued on second left-hand page)

GM DIESEL LOCOMOTIVE

REQUIRES ONLY SIMPLE MAINTENANCE



SOUTHERN RAILWAY
DIESEL MAINTENANCE SHOP
LUDLOW, KY.



OIL AND AIR FILTER CLEANER WITH DRYING OVENS.



MAIN STOREROOM.



GENERAL MOTORS
LOCOMOTIVES

DESIGN
ACILITIES...

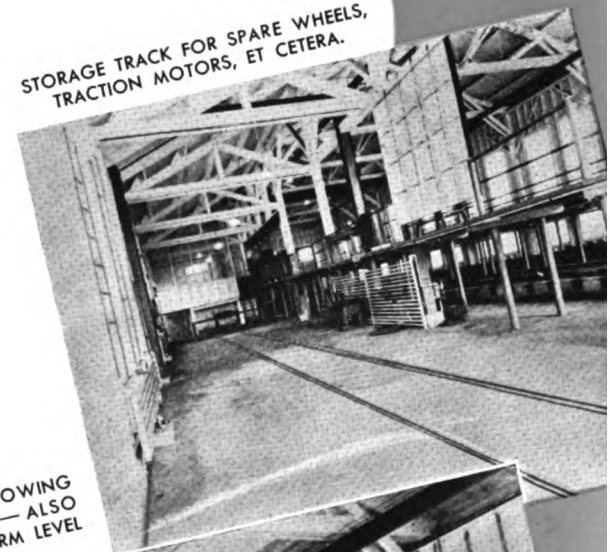
THE philosophy back of Electro-Motive basic design was, and still is, simplicity of construction, ease of operation and maintenance, interchangeability of standardized parts completely finished and ready for application.

The success of this thinking is best evidenced by the outstanding performance of some 1200 General Motors Diesel Locomotive Units, now operating in all classes of service.

The adequate and efficient, yet inexpensive, maintenance facilities of the Southern Railway at Ludlow, Kentucky, here illustrated, are typical of the present trend of railroads using GM Diesel Locomotives.

★ **KEEP AMERICA STRONG—**
BUY MORE WAR BONDS ★

STORAGE TRACK FOR SPARE WHEELS, TRACTION MOTORS, ET CETERA.



RUNNING MAINTENANCE SHOP SHOWING FILTER CLEANING EQUIPMENT — ALSO STOREROOM ON WORK PLATFORM LEVEL SHOWN AT EXTREME RIGHT.



RUNNING MAINTENANCE SHOP SHOWING DEPRESSED FLOOR AND ELEVATED WORK PLATFORM.



ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION LA GRANGE, ILLINOIS, U.S.A.

home near Hammond, Ind. Mr. Beatty was active until shortly before his death, in the management of the Beatty Machine and Manufacturing Company, which concern he founded 26 years ago. He was 66 years old. As a young man he worked with an iron and steel concern in Pittsburgh, Pa., and later as general superintendent of the New Castle Forge and Bolt Company, at New Castle, Pa. Later he was Chicago sales manager for the Williams-White Company, of Moline, Ill. In 1917 he organized his own business, manufacturing heavy metal working tools.

◆

GEORGE T. LADD, chairman of the board of the Woodings Forge & Tool Co., and the Woodings-Verona Tool Works, and president of the United Engineering & Foundry Co., died on October 3, at Pittsburgh, Pa., after an extended illness.

◆

G. L. L. DAVIS, vice-president in charge of sales of the Scullin Steel Company, died October 5. He was 67 years of age. Mr. Davis had been associated with the Scullin Steel Company since 1910.

◆

ALBION JAMES WADHAMS, a vice-president and manager of the development and research division of the International Nickel Company, Inc., in New York, died August 22. He was 68 years old.

◆

CHARLES ROSS DAVISON, mechanical engineer of the Standard Stoker Company, Inc., died suddenly on September 20, of a heart attack, at his home in Erie, Pennsylvania. Mr. Davison was born in Butler County, Pennsylvania, August 3, 1883. After early schooling he attended Westminster College and later Bradley Polytechnic Institute where he received his degree in mechanical engineering. He spent 10 years teaching in Pittsburgh public schools and entered the Locomotive Stoker Company in July 1917. He joined The Standard Stoker Company, Inc., in February, 1928, serving as chief draftsman until 1936 when he was advanced to the position of mechanical engineer. Mr. Davison was a member of the American Society of Mechanical Engineers and held numerous patents on locomotive stokers.



C. R. Davison

◆

L. G. CALDER, president of the Birdsell-Archer Company, Limited, Montreal, Que., died June 14. Mr. Calder had been associated with the company since 1929, when he was elected vice-president and general manager. He became president in 1932.

◆

W. E. HEDGCOCK, vice-president in charge of sales of the American Car and Foundry Company, New York, died on October 26.

◆

P. V. HICKEY, vice-president of the Pantasote Company, Inc., New York, died on October 14.

Personal Mention

General

PETER ROBERT BROADLEY, chief marine engineer of the Central of New Jersey at Jersey City, N. J., has been appointed mechanical engineer, with headquarters at Elizabethport, N. J., succeeding G. W. Rink, who has resigned from that position. Mr. Broadley was born on March 6, 1908,



P. R. Broadley

at Alloa, Scotland. He was a graduate of the Newark College of Engineering in 1932, and a student at the Graduate School of Stevens Institute of Technology. Mr. Broadley entered railroad service on July 20, 1923, as a blueprinter in the employ of the Central of New Jersey at Elizabethport. On November 3, 1924, he was appointed special apprentice and on September 9, 1926, draftsman at Elizabethport. On December 10, 1928, he left the employ of the Central of New Jersey to become draftsman, shop production, rail-car and locomotive division, of International Mack Motors at Plainfield, N. J. He returned to the Central of New Jersey as draftsman at Elizabethport on August 5, 1930. On November 1, 1935, he was appointed mechanical inspector, and on April 1, 1940, chief marine engineer at Jersey City.

JOHN J. MILLER has been appointed chief electrical supervisor, Montreal (Que.) terminals, Canadian National.

R. V. BLOCKER, superintendent of motive power of the Erie at Cleveland, Ohio, has resigned.

HAROLD W. WREFORD has been appointed electrical supervisor, Montreal (Que.) terminals, Canadian National.

W. A. CARLSON, western district master mechanic of the Erie at Meadville, Pa., has been appointed assistant superintendent of motive power, with headquarters at Cleveland, Ohio.

O. J. PROTZ, superintendent of locomotive and car shops of the Chicago & North Western, has been appointed superintendent of motive power, Northern district, with headquarters as before at Chicago.

N. R. CRUMP, assistant to the vice-president of the Canadian Pacific, with headquarters at Montreal, Que., has been appointed general superintendent, Ontario district, of that road, with headquarters at Toronto, Ont.

WILLIAM MOORE, assistant superintendent of motive power of the Erie, has been appointed superintendent of motive power, with headquarters as before at Cleveland, Ohio.

THOMAS F. POWERS, superintendent of motive power of the Northern district of the Chicago & North Western, has been appointed chief mechanical officer, with headquarters as before at Chicago.

ALBERT EDWARD COLEMAN, electrical superintendent of the St. Clair Tunnel at Port Huron, Mich., has been appointed to the newly created position of assistant superintendent of motive power of the Canadian National, Montreal terminals, Que.

R. W. KELLER, supervisor of the Central of New Jersey in charge of all electrical matters at Jersey City, N. J., has been appointed electrical engineer with headquarters at Jersey City.

R. H. BEVERLEY, assistant engineer of tests of the Southern, has been appointed engineer of tests, with headquarters at Alexandria, Va. Mr. Beverley was born in Fauquier County, Va., and is a graduate of Virginia Polytechnic Institute (1900). He entered railroad service in 1901 as an inspector. He was subsequently appointed chief inspector and assistant engineer of tests.

J. E. GOODWIN, mechanical superintendent of the Southern district of the Missouri Pacific at St. Louis, Mo., has been appointed to fill the newly created position of assistant chief mechanical officer, system, of the Chicago & North Western, with headquarters at Chicago.

CHARLES B. BRYANT, engineer of tests of the Southern, has been appointed to the newly created position of assistant to the vice-president, in charge of research and tests, with headquarters at Washington, D. C.

S. O. RENTSCHLER, superintendent of shops of the Missouri Pacific at Sedalia, Mo., has been appointed to mechanical superintendent of the Southern district, with headquarters at St. Louis, Mo.

A. MALMGREN, road foreman of equipment of the St. Louis-San Francisco at Springfield, Mo., has been appointed assistant superintendent of the Southern division, with headquarters at Thayer, Mo.

H. H. THOMAS, assistant master mechanic of the Iowa and Northern Iowa divisions of the Chicago & North Western at Clinton, Iowa, has been appointed superintendent of locomotive and car shops, with headquarters at Chicago.

B. V. JOHNSON, supervisor of repairs, Diesel and motor car service and maintenance of the Union Pacific at Los Angeles, Calif., has been appointed superintendent of Diesel and motor car service and maintenance of the system, with headquarters at Omaha, Neb.

ERIC WYNNE, who has been appointed mechanical engineer, shop methods, of the Canadian National, with headquarters at Montreal, Que., as noted in the September issue, was born at Stafford, England, and came to Canada as a young boy. He entered the employ of the Grand Trunk Pacific (now Canadian National) as a call boy in the mechanical department at Melville, Sask. He subsequently served as a machinist apprentice, and in March, 1921,



Eric Wynne

became a machinist at Edmonton, Alta. After serving in that capacity and as acting foreman, legerwood operator and locomotive foreman at McBride, B. C., Mr. Wynne was transferred to the Fort Rouge shops at Winnipeg, Man., and in June, 1936, was appointed engine inspector. On February 1, 1942, he became supervisor of special work, and on January 16, 1943, mechanical inspector for the System, with headquarters at Montreal.

J. J. THOMPSON, mechanical assistant to the president of the Tennessee Central, has been appointed assistant general manager, with headquarters as before at Nashville, Tenn.

LEWIS S. BILLAU, assistant electrical engineer of the Baltimore & Ohio, has been promoted to the position of electrical engineer, with headquarters at Baltimore, Md.

Master Mechanics and Road Foremen

ELMER HOLMQUIST, master mechanic of the Wisconsin and Madison divisions of the Chicago & North Western, has retired.

J. WALKER has been appointed assistant master mechanic of the Missouri Pacific, with headquarters at Wichita, Kan.

F. D. DUNTON has been appointed master mechanic of the Erie, with headquarters at Avoca, Pa.

H. T. CARTER has been appointed road foreman of engines of the Southern, Eastern lines, with headquarters at Alexandria, Va.

H. I. PHELPS, master mechanic of the Erie at Avoca, Pa., has been transferred to the position of master mechanic at Secaucus, N. J.

E. BRANNING, master mechanic of the Erie at Secaucus, N. J., has been transferred to the position of division master mechanic at Hornell, N. Y.

EDWARD POOL, division master mechanic of the Erie at Hornell, N. Y., has been promoted to district master mechanic, with headquarters at Meadville, Pa.

A. WALKER, assistant master mechanic of the Wichita division of the Missouri Pacific at Wichita, Kan., has been transferred to the position of assistant master mechanic at Kansas City, Mo.

A. O. ELLIOTT has been appointed road foreman of engines of the Southern, Eastern lines, with headquarters at Alexandria, Va.

F. L. BAKER, master mechanic of the Galena division of the Chicago & North Western, has been appointed master mechanic of the Wisconsin and Madison divisions, with headquarters as before at Chicago.

A. H. BAIR has been appointed master mechanic of the Union at East Pittsburgh, Pa., succeeding George Sanders, whose illness prevents his fulfilling the duties of this position.

W. A. LANGLANDS, master mechanic of the Chicago Terminal division of the Chicago & North Western, has had his jurisdiction extended to the Galena division. His headquarters are at Chicago.

C. L. CHRISTY, assistant master mechanic of the Kansas City Terminal division of the Missouri Pacific at Kansas City, Mo., has been appointed master mechanic of the Omaha-Northern Kansas and Kansas City Terminal divisions, with headquarters at Falls City, Neb.

MERCEIL J. BRADY, who has been appointed master mechanic of the Canadian National with headquarters at Calgary, Alta., as announced in the September issue, was born on December 15, 1896, at



M. J. Brady

Oswego, N. Y. He entered railroad service in September, 1912, as a machinist apprentice in the employ of the Canadian Pacific, serving at Alyth and Ogden shops, Calgary, until July, 1917, when he transferred to the Canadian National as a machinist at Hanna, Alta. In June, 1936, he became assistant locomotive foreman at Wainwright, Alta.. in April, 1941, locomotive foreman at Kindersley, Sask., and in June, 1943, master mechanic of the Calgary division.

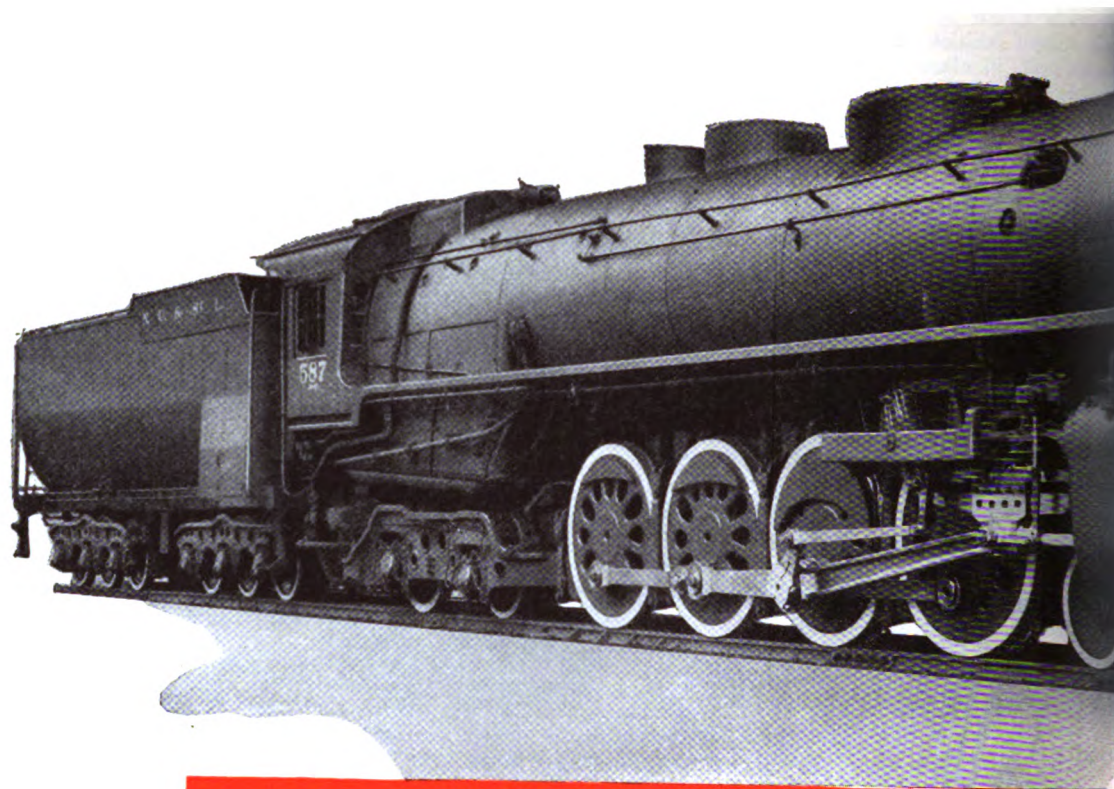
L. H. RABUN, who has been appointed master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Savanna, Ill., as noted in the August issue, was born on March 1, 1896, in Chattanooga, Hamilton Co., Tenn. He attended grade and high schools and the Southern Commercial



L. H. Rabun

School at Chattanooga, and entered railroad work on September 12, 1912, as a machinist apprentice in the employ of the Cincinnati, New Orleans & Texas Pacific at Chattanooga. From February, 1917, to October, 1922, he was a machinist successively in the employ of the Great Northern, Northern Pacific, Denver & Rio

(Continued on second left-hand page)



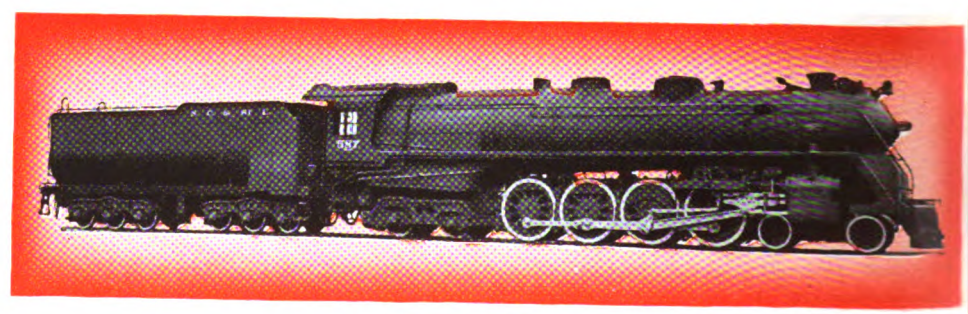
5
Delivered in March
1930

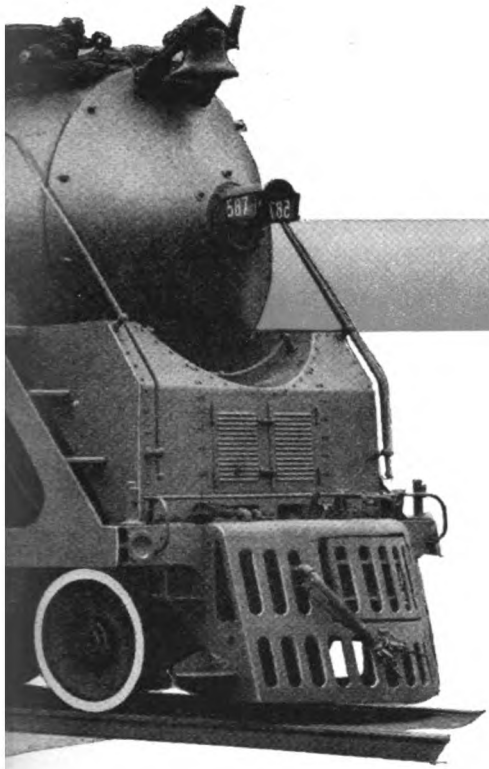


10
Delivered in July
1942



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1943





THE DIXIE LINE

The Nashville, Chattanooga and St. Louis Railway placed in service in 1930 five 4-8-4 type Alco locomotives. A steady increase in traffic created a vital need for more motive power. As a result ten improved 4-8-4 type locomotives were delivered to this road by Alco in July, 1942, and only recently, in September, 1943, Alco delivered ten more.

Right now the railroads are handling the heaviest traffic on record. Powerful steam locomotives of proven design are in large measure responsible for this outstanding performance.

Locomotive Characteristics

Weight on Drivers	228,000 Lb.	Boiler Pressure	250 Lb.
Weight of Engine	399,000 Lb.	Tractive Power	57,000 Lb.
Cylinders	25 x 30 Ins.	Tender Capacity, Fuel	16 Tons
Diameter of Drivers	70 Ins.	Tender Capacity, Water	15,000 Gals.

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Alco

Grande, Great Western, Missouri Pacific, and the Chicago, Milwaukee, St. Paul & Pacific. He was appointed assistant enginehouse foreman of the latter road at Kansas City, Mo., on October 15, 1922; assistant enginehouse foreman at Davenport, Iowa, on January 15, 1923; assistant enginehouse foreman at Ottumwa, Iowa, on September 1, 1923; assistant foreman at Sioux City, Iowa, in April, 1925; enginehouse foreman at Soo Falls, S. D., in April, 1932; enginehouse foreman at Miles City, Mont., on September 1, 1932; enginehouse foreman at Mobridge, S. D., on December 15, 1932; general foreman at Ottumwa on May 1, 1934; assistant master mechanic of the Chicago Terminals and Terre Haute division on May 1, 1941, and division master mechanic of the Dubuque-Illinois and Kansas City division, with headquarters at Savanna, on July 1, 1943.

Car Department

E. W. PEARSON, who has been appointed mechanical engineer (car) of the Canadian National at Montreal, Que., as noted in the October issue, is a native of Hull, England. He entered railroad service



E. W. Pearson

in October, 1910, as a draftsman in the mechanical department of the Canadian Northern (now Canadian National) at Winnipeg, Man. In 1916 he was transferred to Toronto, Ont., and in March, 1919, was appointed acting chief draftsman. Mr. Pearson was appointed assistant chief draftsman of the Canadian National at Montreal in 1923, shortly after the re-organization of that road.

Shop and Enginehouse

C. R. KILBURY, master mechanic of the Omaha-Northern Kansas and Kansas City Terminal divisions of the Missouri Pacific, has been appointed superintendent of shops, with headquarters at Sedalia, Mo.

WALTER H. OHNESORGE, whose appointment as superintendent of the locomotive repair shops of the Boston & Maine at North Billerica, Mass., was noted in the August issue, was born on July 12, 1885, at Dubuque, Iowa. He attended high school and obtained further education through the International Correspondence Schools and at the Harvard School of Transportation. He became a machinist apprentice in the employ of the Chicago, Milwaukee & St. Paul on August 21, 1902. After serving his apprenticeship he was employed in the shops of the Chicago Great Western at



W. H. Ohnesorge

Oelwein, Iowa. Mr. Ohnesorge then worked on various other railroads throughout the country, including "Old Mexico." He returned to the Chicago, Milwaukee & St. Paul in October, 1908, as a machinist and worked at Dubuque, Iowa, and North McGregor. He became a machinist in the employ of the Northern Pacific at Livingston, Mont., in July, 1912. In July, 1913, he again entered the service of the Chicago, Milwaukee & St. Paul as a machinist at Seattle, Wash. In 1916 he became foreman and general foreman, serving successively at Cedar Falls, Wash.; Othello; Miles City, Mont., and Austin, Minn. He became general foreman of the Western Maryland at Cumberland, Md., in January, 1924. From September 1, 1925, until March 1, 1926, he was employed by the Boston & Maine at Westboro, N. H. On the latter date he was transferred to Mechanicville, Me., as general foreman, and on February 21, 1927, was appointed master mechanic. He became general inspector of locomotive maintenance, with headquarters at Boston, Mass. on January 1, 1929, and general foreman at Billerica on August 16, 1933; assistant shop superintendent on July 1, 1941, and shop superintendent on July 1, 1943.

Obituary

CHARLES HEPBURN ANDRUS, at one time a master mechanic on the Pennsylvania Railroad, died at Sinking Springs, Pa., August 23, 1943. Mr. Andrus was born at Williamsport, Pa., September 7, 1864, and entered Pennsylvania Railroad service June 1, 1875, as a messenger on what is now known as the Williamsport division. He served continuously on that road in the following capacities: 1880, machine apprentice, Middle division; 1884, machinist and then fireman, Philadelphia division; 1888, engineman, Schuylkill (now Wilkes-Barre) division; 1899, road foreman of engines, Schuylkill division; 1903, general foreman, motive power department, Philadelphia division; 1904, general foreman, Philadelphia Terminal division; 1906, locomotive inspector; 1913, master mechanic, Philadelphia division; 1916, master mechanic, Renovo division; 1919, shop inspector, Williamsport division; 1920, shop inspector, Sunbury division; 1921, engineman, Schuylkill division. Mr. Andrus retired in 1929 because of impaired eyesight.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

PIPE TOOLS.—Beaver Pipe Tools, 300-400 Dana avenue, Warren, Ohio. Catalog No. 44, 48 pages illustrated. Beaver pipe tools—beveling tools, pipe cutters, electric pipe and bolt machines, grooving tools, threaders, etc. Prices given.

◆

TANTUNG TOOLS.—The Vascoloy-Ramet Corporation, North Chicago, Ill. Attractive 24-page catalog. Contains dimensions and list prices of various Tantung tools, and information on how to grind and how to braze Tantung, as well as performance data showing the results obtained by its use in various machining operations.

◆

BRAKE-BEAM SUPPORT.—Grip Nut Company, Chicago. Four-page illustrated bulletin entitled "Universal Brake Beam Safety Support Adjustable." Describes the support and its operating advantages. A 17-in. by 24-in. wall chart which gives illustrated instructions for the proper installation and maintenance of the brake-beam support is also available.

◆

"HOW TO MAINTAIN ELECTRIC EQUIPMENT."—General Electric Company, Schenectady, N. Y. A 372-page, 8-in. by 10-in. illustrated book, bound in stiff covers. Price, $1.75. Includes 21 chapters on how to maintain battery trucks, bushings, cable and wire, capacitors, industrial Diesel-electric locomotives, electric furnaces, fuse cutouts, industrial control, electronic control instruments, lighting equipment, lighting arresters, midget heaters, mine locomotives, motors and generators, rectifiers, regulators, switchgear, turbines and welders, and on how to use insulating varnishes and compounds. As an example, the chapter on how to maintain rectifiers includes general information, a preventive maintenance schedule, data on how to detect misfires, how to detect a faulty rectifier, how to remove an ignitor, how to clean tanks, corrosion prevention in cooling systems and a trouble-shooting chart. Three additional chapters contain technical data including treatment for electric shock and information on renewal parts and General Electric service shops.

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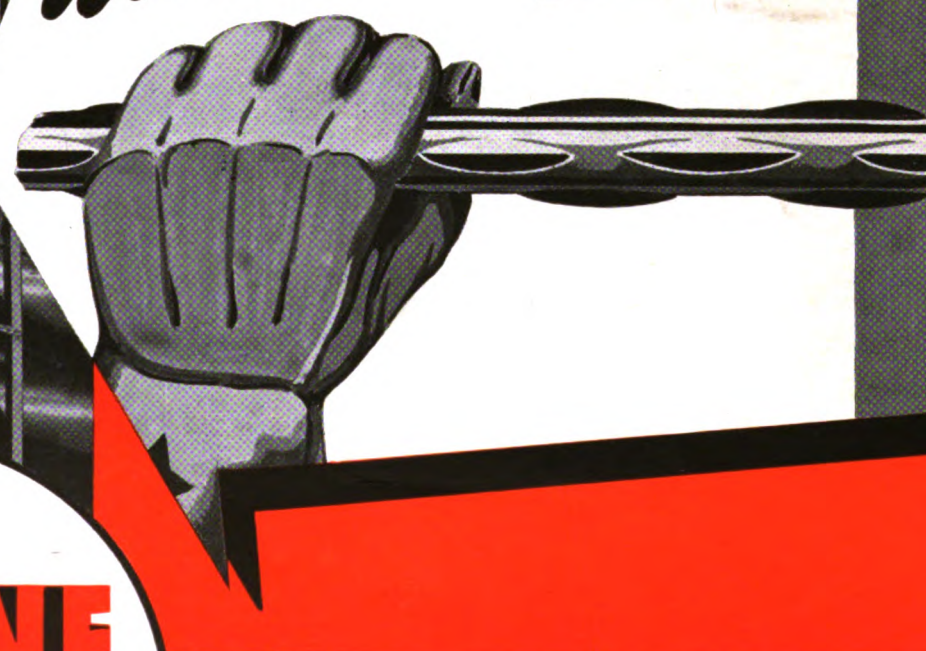
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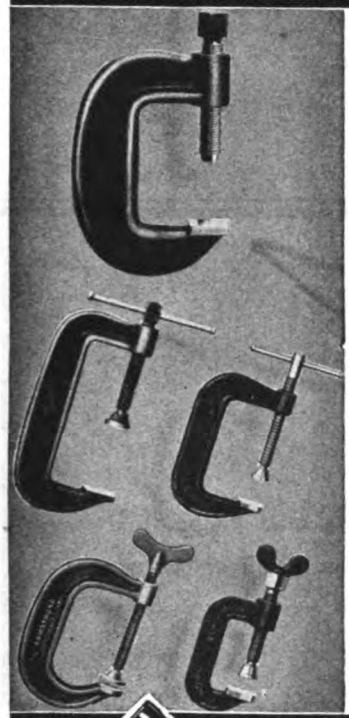
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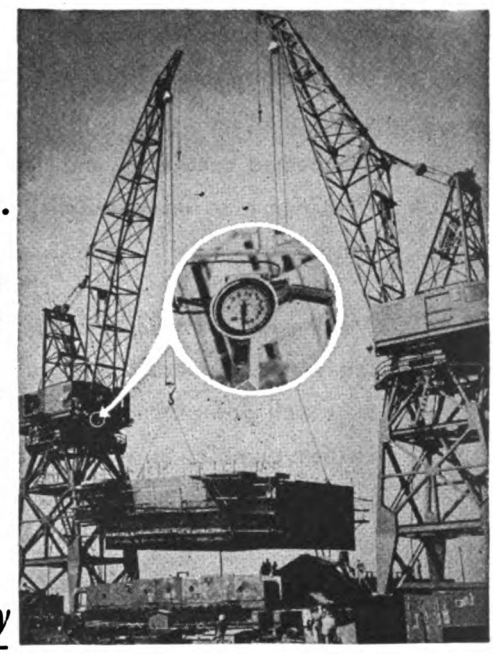
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THE EDITOR'S DESK

MATERIAL SITUATION CHANGING

We are in a period of marked changes in the material situation. During the early part of the war it was necessary to establish and build large camps and training grounds and to build and equip manufacturing plants of all sorts to furnish equipment and supplies for war purposes. With our armed forces spread all over the world it was necessary to assemble vast quantities of materials and equipment to meet any possible emergency on any front. Billions upon billions of dollars were expended in this effort. Now the task is settling down to one of maintaining a steady flow of supplies and equipment, or to meet new and unexpected conditions, and the whole situation is changing, so far as material requirements are concerned.

Many materials and much equipment are available today, not only for those essential projects which were well down on the list of priorities, but for civilian purposes as well. In other words, the material situation is easing up in certain respects and the bottleneck, so far as transportation and industry are concerned today, is largely manpower. With these changing conditions—and they may be more or less kaleidoscopic in the coming months — the railroad mechanical departments must study developments critically and be prepared to act promptly to take advantage of new opportunities. It will require intelligent planning and real strategy to step in and quickly take advantage in the purchase of facilities, materials and equipment which will help to conserve manpower and increase the output per man-hour.

The railroads are being criticized severely in some quarters because they have not taken advantage of these changing situations. The statement has been made that they were not as aggressive as they should be in presenting their claims to the W.P.B. and in insisting upon securing the necessary materials and equipment. It is even said that some of them have not even made requests at Washington for much needed materials. Whether these charges are true or not, it would seem that the time has now come when the railroads, if they are to continue to operate successfully, must be given substantial relief in the way of additional equipment and materials. Even then, the manpower situation is such that these additional facilities must be carefully selected, with a view to conserving manpower and increasing the unit output.

Roy V. Wright

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DECEMBER, 1943

Volume 117 *No. 12*

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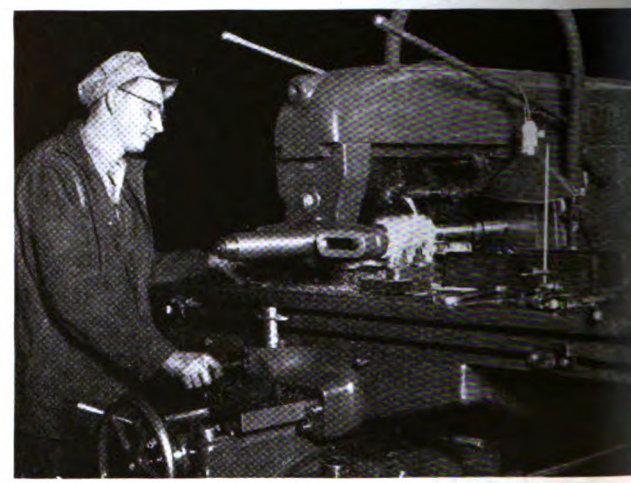
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The Western Maryland was prepared for this oil fire with extinguishing materials and necessary protective clothing for employees

Oil Fire Danger Met by

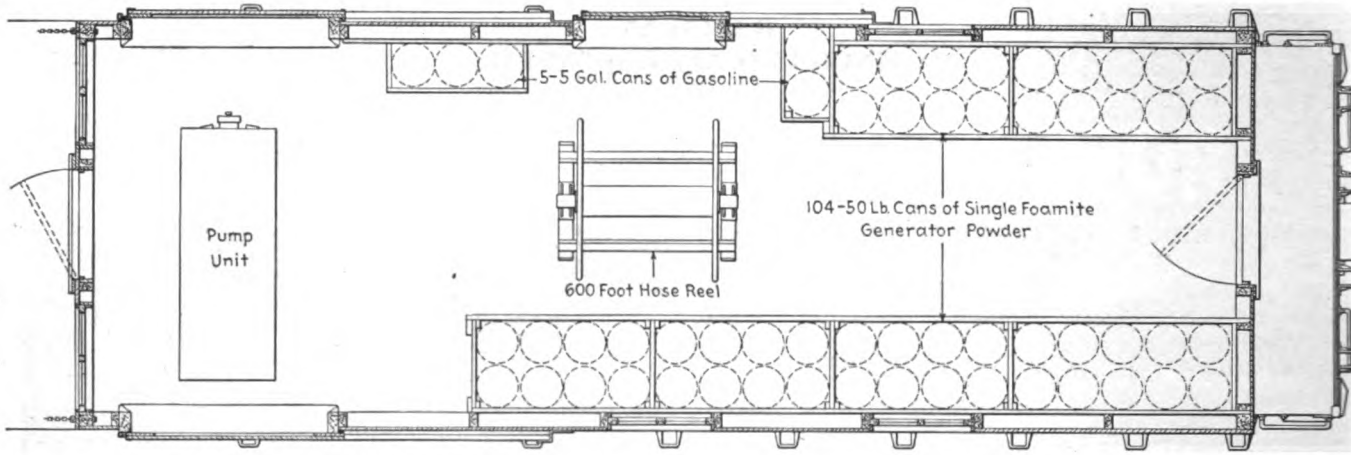
Railroad Fire Fighting Cars

Two extinguishing systems in general use—Equipment design varies—Protection afforded to all property along right of way

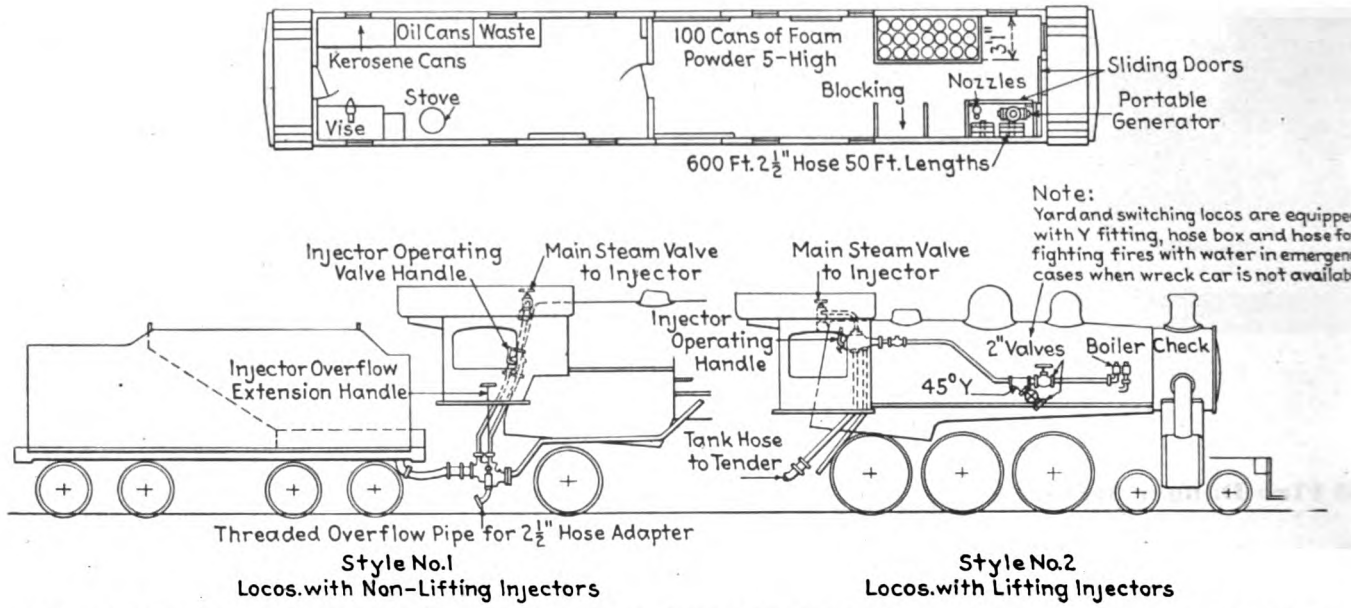
UNPRECEDENTED wartime movements of petroleum products and other combustibles which move in tank cars presented a definite fire hazard which the railroads were compelled to meet. The potential danger in handling tank cars, sometimes in solid trains, at relatively high speeds has been prepared for on most roads by the construction of special fire-fighting cars equipped for use at fires resulting from the carrying of high-volatile gasolines, crudes or other flammable liquids. Some roads which already had fire cars in service added oil-fire-fighting apparatus to their existing equipment until their shops were able to build units intended primarily for use on tank-car fires. Those roads which had not previously used fire cars are now in a position to combat oil fires and at the same time have wreck train equipment for service at fires along the right of way, in car yards or at other points where assistance is not readily available from municipal fire departments or other sources. The cars built or being built by various roads are, therefore, of permanent value in decreasing the likelihood of fire losses in general.

Much thought has been devoted by mechanical department officers to designing and equipping these cars. Numerous factors had to be considered among which were—the volume of tank-car traffic handled, physical characteristics of the right-of-way, availability of materials and supplies, number of units authorized and the choice of the extinguishing method to be employed. Most of the equipment being placed in service makes use of box cars from which a portion of the superstructure is removed and replaced with a tender tank to serve as a source of water supply in localities where no roadside supply is readily available. A variation of this arrangement is the use of a flat car on which a house structure for pumps, generators, tools and supplies and a tender tank are mounted. Some roads which draw their water supplies directly from the tender of service train locomotives use either flat cars or regular wreck train cars to carry supplies and needed auxiliary equipment.

An understanding of the problems involved in fighting



House portion of Pennsylvania fire-fighting car—Racks at the sides hold various size nozzles and connections, suction hose and other equipment



Above: Arrangement of supplies in Lehigh Valley wreck train cars.—Below: Lehigh Valley instructions covering use of injectors to supply water under pressure to the foam generator

tank car fires was necessary to design and equip these cars properly. A common misconception is that the flammable liquids carried in tank cars burn. Actually it is the vapors coming from these liquids which burns; the formation of the vapor depending upon the volatility of the liquid and on the temperature to which it is subjected. Combustion can only be supported in the presence of a sufficient supply of oxygen and, even then, the combination of vapor and oxygen will not burn without a source of initial ignition to start the burning.



The Western Maryland tank car fire well under control

In extinguishing any fire there are four possible methods of procedure; only two of them are likely to be of value in the case of tank-car fires. The four methods are (1) cooling, eliminating the heat required for vaporization and the ignition of the fuel; (2) blanketing, stopping the release of fuel vapor; (3) starving, interrupting the flow of fuel; and (4) diluting, bringing the vapor-air mixture below the combustible limit. The first two are the methods most commonly employed in fighting railroad oil fires. The cooling process is one in which a fine spray of water is directed over the fire area and serves to reduce temperatures to a point where the flammable material will no longer vaporize. This fine mist of water is obtained by utilizing spray or fog nozzles. On oil fires, the spray or fog is more effective than the action of a direct stream from a standard nozzle which, because of its force, tends to spread a fire rather than to cover it with a cooling mist of water. In addition, spray nozzles increase the time that a given supply of water will last about five to one over the requirements of a standard nozzle.

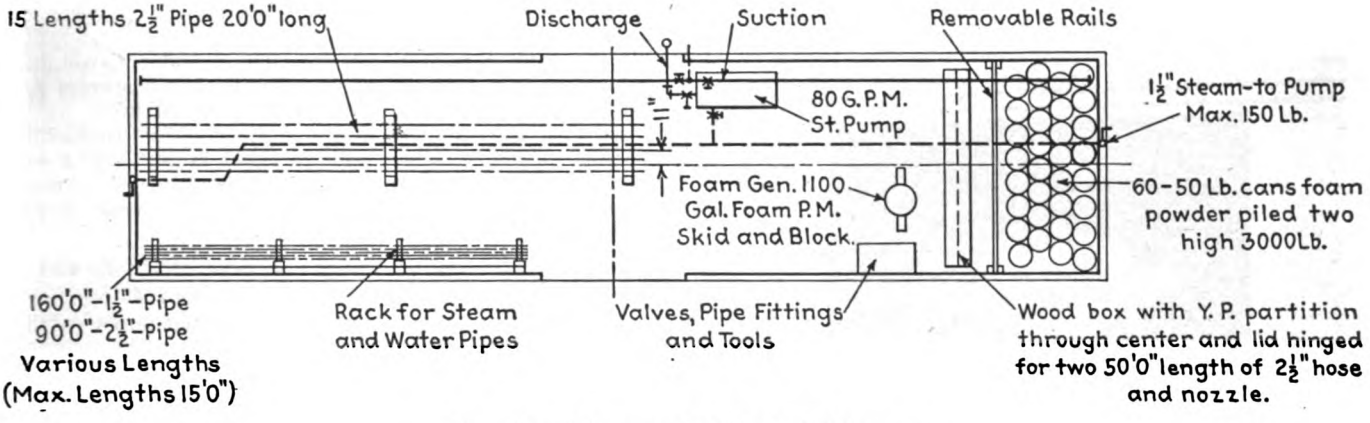
Blanketing depends upon spreading an airfoam of water and chemicals over the fire area. Two methods are generally employed to produce this blanketing foam:

one uses a generator into which a powdered chemical compound is charged to be mixed with water coming from a pump or other pressure source, the foam so created being discharged under pressure at the delivery nozzles; the other utilizes a special mixing nozzle so designed that when operating under pump or other pressure it can be used to draw a liquid foam generating compound through a special flexible connection from a container carried by the man who is handling the nozzle at the scene of a fire. This is accomplished by the design of the delivery outlet which creates a suction on the liquid in the container. Air is also drawn into the line and the action is such that a mixture of water, air and liquid compound forms a foam discharged under pressure at the nozzle tip. Both methods produce a foam which floats on the surface of burning liquids or adheres to surfaces against which it is directed. This serves to exclude air which contains the oxygen required to support combustion. The foam systems also increase the effectiveness of the usually severely limited supply of water which can be carried on a fire-fighting car or drawn from a locomotive tender to an appreciable extent over that obtained from spray or fog nozzles.

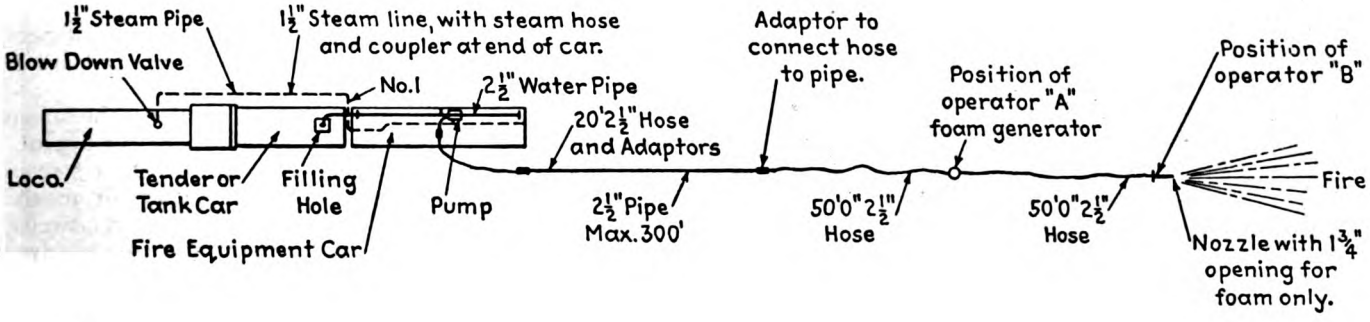
Instructions issued to fire crews on the Baltimore & Ohio indicate the procedure generally followed when the foam generator system is employed. The foam generators and powder are supplied by the American-LaFrance-Foamite Corp., Elmira, N. Y. Although the



A demonstration given on the Erie to familiarize supervisors and employees with new fire-fighting facilities

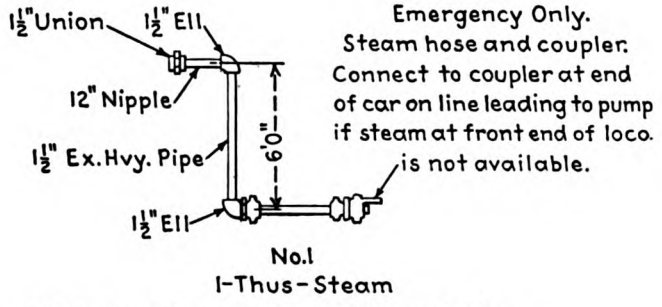


Floor plan of Baltimore & Ohio fire-fighting cars

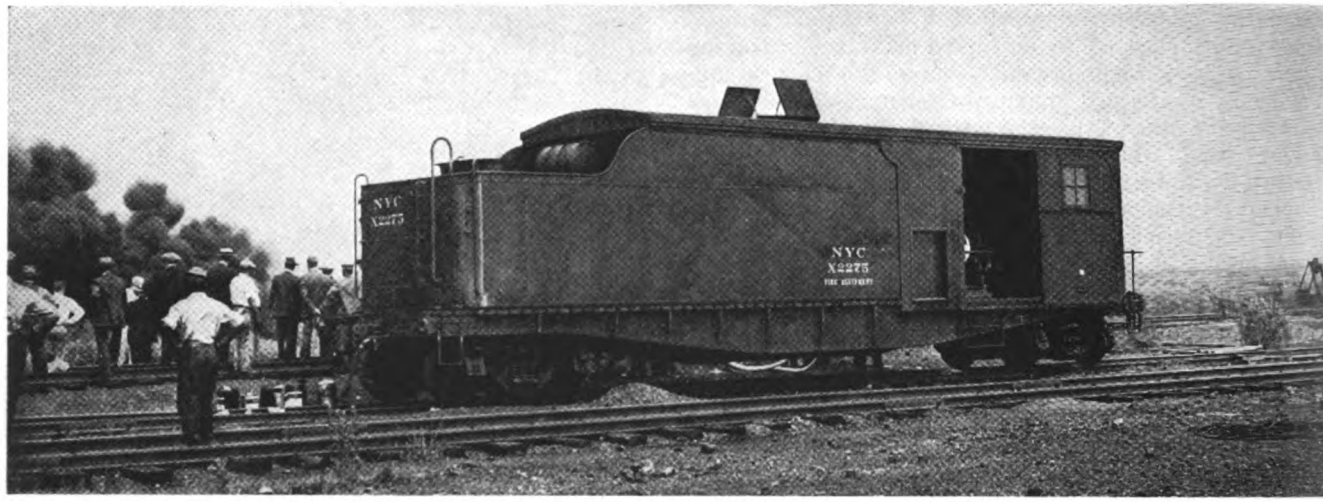


Piping Arrangement

If loco. is equipped with steam heat hose connect with pump line, otherwise use detail No.1 and connect to line from valve on loco. max. pressure 150 lb.



A typical layout illustrating the use of foam fire-fighting equipment as it is employed on the Baltimore & Ohio

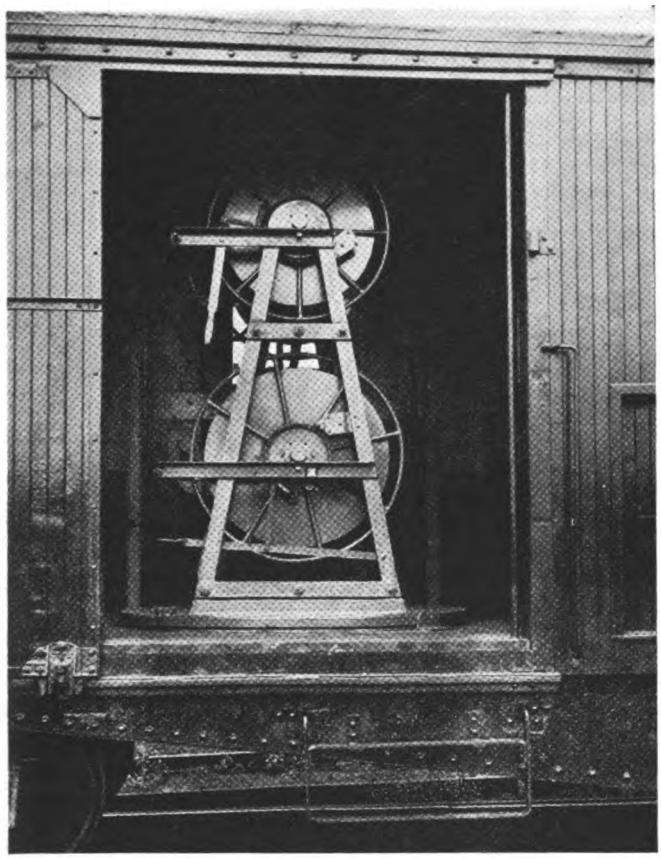


The New York Central is installing ten cars of this design—A gas engine-operated pump is installed in the former coal space of the tender

B. & O. uses pipe where other roads depend upon fire hose the sequence of operations is typical:

1—The locomotive and tender with coupled fire fighting car should be located a suitable distance from the fire, up to 450 ft.

2—Connect the pump in the car to the steam supply from the locomotive and to the water supply from the tender tank with a pipe



Hose reels on this N. Y. C. car are on a turntable so hose can be taken out at one end or either side

3—Locate foam generator approximately 50 to 125 ft. from the fire.

4—Connect foam generator to water supply from pump using 50 ft. of hose between generator and end of 2½-in. pipe from pump

5—Connect opposite end of foam generator to 2½-in. hose to which is attached play nozzle

6—Cans of foam powder shall be conveniently located near generator

7—Open water valve between tender tank and pump and place operator in position at play pipe nozzle

8—Open steam valve between locomotive and pump and water will be forced through generator; steam pressure to pump not to exceed 150 lb.

9—As water flows through generator, operator should pour contents of 50 lb. container of foam powder into hopper of generator while operator at nozzle directs foam on fire

10—Water pressure of not less than 50 lb. is required for operation of the generator and the 3,000 lb. of foam powder will be sufficient for about one hour's operation. Use nozzle with 1¾ in. tip for foam on oil fires; for other than oil fires use water only with ¾ in nozzle tip.

The steps as outlined are those generally followed in using foam generators although, as has been shown, some roads draw their water supply from special tanks carried on the fire car. These roads also use gasoline pumps which permits releasing the assisting locomotive after the fire car is spotted in location. The New York Central has an arrangement whereby, during very cold weather, the water in the fire-car cistern is kept warm by steam connections when in the yard and by the locomotive while en route to fires. When the car is uncoupled from the locomotive the water is of a sufficient temperature that the danger of a freeze-up and interruption to the water supply is remote.

The Lehigh Valley, which also employs the foam generator system, uses the locomotive tender for a water supply and the locomotive injector to provide a stream of water under pressure through the generator to the nozzle. Necessary supplies and equipment are carried in cars assigned to wreck trains. On locomotives equipped with non-lifting injectors, the fire hose connection is made at the injector overflow pipe. On locomotives with lifting injectors, that operate with self-closing overflow, the hose connection is made at the delivery pipe by disconnecting the delivery pipe at the boiler check, or to a 45 deg. Y-connection in the branch pipe on locomotives so equipped. Adapters are used to make the connections and the desired pressure of 100 to 120 lb. is obtained by manipulating the injector main steam valve.

The operation of the foam making nozzles using a liquid compound known as Phomaide solution is in use on the New York Central. The nozzles and solution are the products of the Pyrene Manufacturing Co., Newark, N. J. A supply of 8,000 gallons of water is carried

(Continued on page 584)

American Car and Foundry Builds

Troop Kitchen Cars

A.A.R. box-car design modified for special use—Convenient facilities speed service of food—The strain on baggage cars relieved

SINCE the beginning of the expansion of the nation's armed forces railroad baggage and express cars have been depended upon by the Army for use as kitchen cars during the mass movement of troops. Regular field equipment was installed in these cars for the use of the mess details, each unit stocking these cars at departure points and removing its equipment at destination. This makeshift arrangement took many cars out of regular service and was, at best, only moderately satisfactory.

The American Car and Foundry Company is now building at its Chicago plant 400 specially designed troop kitchen cars which will be used by the Transportation Corps, Army Service Forces, for troop movements in this country in conjunction with troop sleeping cars or other passenger equipment. The first car completed was exhibited at Washington, D. C., to War Department, Navy, Marine and Coast Guard officers on Tuesday, October 26.

The A. A. R. standard 50 ft. 6 in. box car was adopted as a basic design and modified with details worked out by the offices of the Chief of Transportation and the Quartermaster General. The cars are arranged for later conversion to box cars with 8 ft. side doors or express cars for passenger train service.

The steel framing for the underframe, sides and roof follow very closely corresponding A. A. R. standard box car details. The end framing, which is arranged for the end-door opening, is designed to meet A. A. R. requirements for passenger train equipment. The trucks are of the high-speed built-up type. Clearance dimensions will permit the use of these cars wherever passenger trains are operated. The safety appliances meet all requirements.

The sides, ends and roof are insulated with 1-in. Fiberglas secured in the sides and ends with spot-welded nails. The double wood floor is of tongue-and-groove yellow pine, the bottom course being 1¾ in. laid crosswise and the top course 1⅝ in. laid longitudinally. A ramp of non-skid steel floor plate is provided at each side door to take care of differences in elevation between platform floor levels and the car body floor. The side and end lining is tongue-and-groove $^{25}/_{32}$-in. fir covered with ¼-in. fir plywood, and the headlining is No. 16 gauge steel.

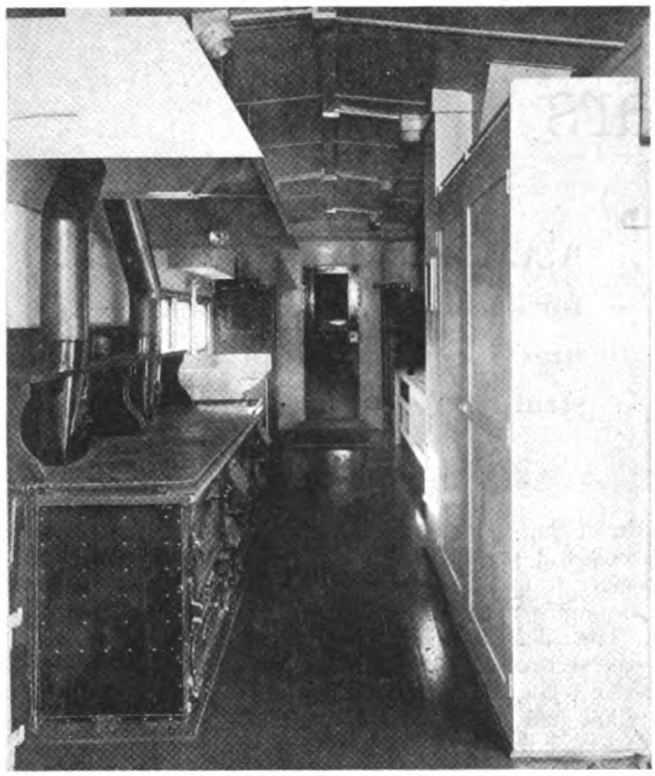
The hinged end doors and the inside sliding side doors are of wood covered with steel sheet and both end and side doors have drop sash with hinged screens. The end door openings are 2 ft. 3 in. wide and the side-door openings are 4 ft. wide by 6 ft. high. A safety bar is provided across each end-door opening pivoted to a bracket on the main body end post. The side-door openings are protected by door guards of standard pipe with a pivoted bottom section of expanded metal. Raising the expanded-metal section provides for loading materials into the car. There are 14 windows having sliding sash arranged to raise and equipped with inside screens

Dimensions and Weight of the Army Kitchen Cars

Length inside, ft.-in.	50.6⅛
Length over buffers coupled, ft.-in.	54.2⅛
Truck centers, ft.-in.	40.8½
Width inside, ft.-in.	9.1½
Height inside at center, ft.-in.	9.$^{15}/_{16}$
Height from rail to top of floor, ft.-in.	3.9⅜
Light weight, lb.	77,500



Troop kitchen car built by the American Car and Foundry Company for the Defense Plant Corporation



Working surfaces are large and plenty of shelf and screened cupboard space is provided

also arranged to raise. Each window has a roller curtain which overlaps the window opening at all edges. Similar curtains are provided at the end- and side-door drop sash. Nine pivoted ventilating sash with flush outside screens are installed in the sides of the car close to the side plate, and 11 galvanized-steel exhaust ventilators are installed on the roof with screened openings outside and registers with adjustable shutters inside.

Heating, Brakes and Lighting

The cars are heated by the Vapor Car Heating Company's system of steam heat, there being four plain pipe coils, one located in each corner of the car equipped with manual steam supply valves. The water supply is furnished from an air-pressure water system with air supplied from the emergency reservoir of the air-brake equipment. A hand-operated air pump is located under the sink for emergency use when the cars are standing without an air connection. Water supplies for the sink and for the shower are separate. Two 200 gal. cold-water tanks and one 40 gal. hot-water tank furnish the sink supply, and one 82 gal. cold-water tank and one 30 gal. hot-water tank are connected to the shower. Water for the shower is heated by a Vapor water heater and for the sink by a similar heater and the water backs of the ranges.

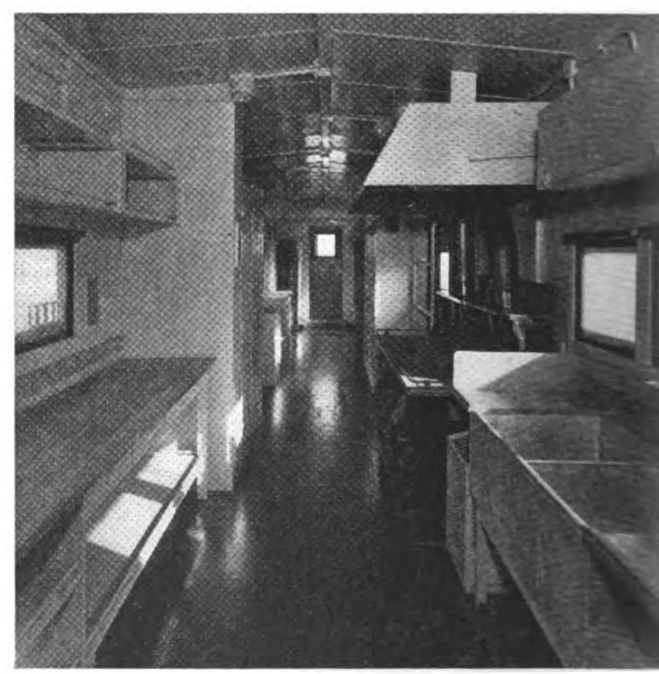
Air-brake equipment, furnished by Westinghouse, is the AB-1-B-10 type having two brake cylinders and two AB valves, each operating the brakes on one truck. Air signal equipment is also included. A hand brake is placed at one end of the car located inside the main body end post which serves to operate brakes on one truck only.

The car is lighted by a battery system using fixtures of the lens type which direct light to the working surfaces. Current is supplied by National Carbon Company's replaceable "Eveready" air cell batteries which provide approximately six volts at the fixtures. Six months is the estimated life of batteries under anticipated normal lighting requirements. There are twelve lighting fixtures arranged on two circuits with snap switches, and, in addition, one night light fixture at each end of the car controlled by pull switches.

Car Interior

The interior equipment is of sturdy construction and arranged for convenient use. It consists of two U. S. Army coal ranges connected in tandem. Each range is equipped with water backs, and the smoke pipes from both ranges are connected to a smokejack of a positive exhaust type. A canopy is installed over the ranges with duct connections to two roof exhaust ventilators. The ranges are located on one side of the car adjacent to the side door opening. A coal box of ½ ton capacity is located opposite the range and has a roof hatch for loading with coal. An expanded-metal bin is installed next to the range for wood. Adjacent to the range is a deep sink of heavy galvanized steel having a center partition with wooden drain boards and a splash back. A single swing faucet is provided for hot and cold water supply. Across the car from the sinks is the cook's work table with shelves and drawers below and shelves above. All shelves are furnished with a marine type railing of ⅜-in. pipe. Across the car from the range a utensil cupboard with sliding doors is located and on the other side of the door opening is a refrigerator of counter height. It has two ice wells of approximately 7½ cu. ft. capacity each, with a food compartment between of approximately 15½ cu. ft. capacity. Next to the refrigerator is the meat-cutting table which is also equipped with drawers and shelves below. Shelving is likewise provided above the refrigerator and meat-cutting table. On the opposite side of the car, adjacent to the door opening, the bread locker with shelves below is located and next to this, toward the end of the car, there is a service table supported on three stout stools when in use and carried in brackets on the side of the

(*Continued on page 584*)



Convenient interior arrangements facilitate the preparation of meals for soldiers—A shower bath for the kitchen crew is on the left at the end of the car

Gas Turbine Locomotives



L. P. Michael,
Chairman

Traveling Engineers' committee, of which L. P. Michael is chairman, reports progress in gas-turbine development—Rolling-ball universal joints for mechanical drive shafts described

IN the research which this committee has made on the design and development of a 6,000-hp. locomotive that would come within weight limitations of 430,000 lb. at rail, and which could be built in one unit and carried on two six-wheel trucks with all axles and wheels power driven, it is estimated that it will be necessary to use a *prime mover* of a type that will produce power through rotary instead of reciprocating motion, such as a turbine which produces a constant uniform power torque. The turbine can be operated at a much higher speed in revolutions per minute than the reciprocating type engine and for this reason can be constructed to develop more power per pound of weight than the reciprocating type engine, and therefore, the turbine prime mover can be constructed within required weight limitations.

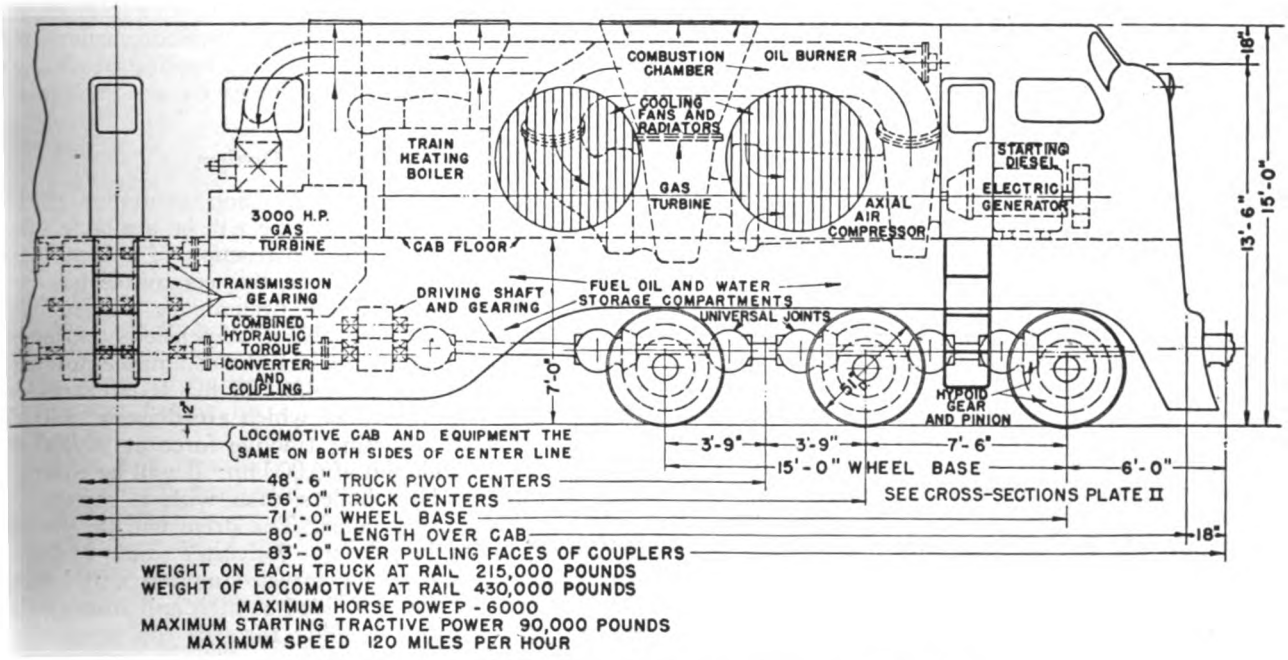
It is also considered necessary to use a *direct mechanical power transmission* instead of an electrical transmission for the reason that the latter, as near as can be estimated, would weigh between twenty and twenty-five per cent more than the mechanical transmission.

The electrical transmission has many desirable features, but it is estimated that the weight, first cost and maintenance cost for the electric generators, controlling equipment and motors, will be considerably greater and the efficiency less than for the direct mechanical transmission, which can be so constructed that it will come within required weight limitations.

In its study of this subject, this committee first considered the use of a steam turbine as a prime mover and spent considerable time and energy developing same. The estimates made, however, indicated that the weight and space required for the high-pressure steam boiler or generator and exhaust-steam condenser would be too great to permit a 6,000-hp. power plant locomotive to be constructed in one unit.

About this time the developments of the gas turbine were so promising, and have continued to be so, that it was considered desirable to plan to use this type of prime mover on the proposed locomotive design.

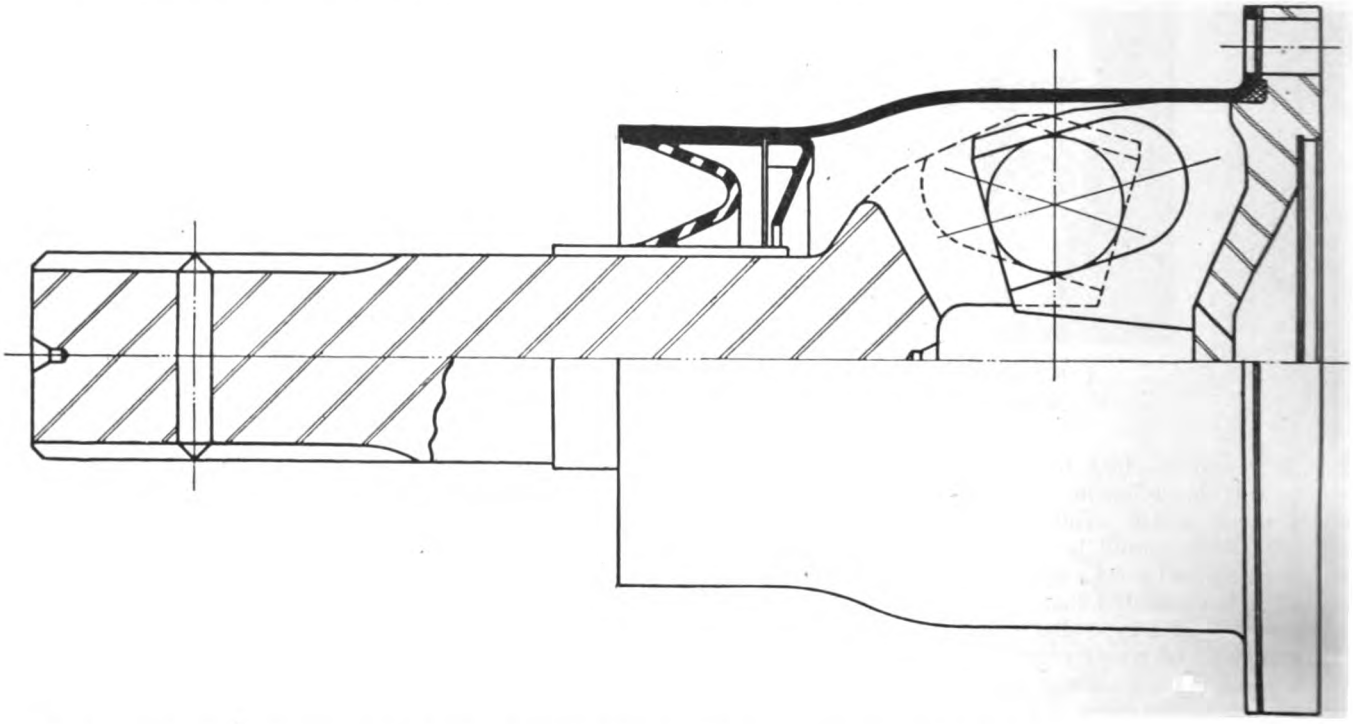
With the use of a gas turbine, the high-pressure steam boiler and the low-pressure exhaust-steam condenser are both eliminated and instead of a high- and low-pressure



Proposed gas-turbine locomotive with hydraulic-mechanical transmission

steam turbine, a low-pressure gas turbine will be used, which will be more rugged and efficient than the compound steam turbine.

Another very important feature of the gas turbine is that a low grade fuel oil, Bunker "C" or Number 6 fuel oil, can be used, and which costs about half that required for the refined distillate for Diesel engines. Further, with the gas turbine no water is required on the locomotive, except that required for generating steam for heating passenger-train cars.



A Bendix-Weiss rolling-ball universal joint designed for a maximum shaft angle of 10 deg. and for plus or minus ½ in. rolling end motion, with flexible dust and lubrication seal

Progress and Developments

War conditions have considerably delayed developments. However, the Allis-Chalmers Manufacturing Company, has been for several years, making intensive studies of the gas turbine and has built a number of them.

On June 24, 1943, their engineers wrote as follows:

The status of this work has advanced considerably beyond the stage mentioned to you and covered in your last year's report.

The gas turbines that we are building for the government projects are rapidly nearing completion but none is in operation as yet.

As can be expected in highly developmental contracts, such as these, delays were encountered due to lack of previous experience in connection with certain items. For instance, the forging of the high temperature alloys in the sizes that are being considered on some of these projects was an undertaking that had never been attempted heretofore and time was consumed before a suitable forging procedure was worked out.

We are investigating the possibility of using pulverized fuel in connection with the gas turbine. The equipment for this later project has been set up and burning experiments are being started.

The work that Battelle Memorial Institute has been performing for us on high temperature materials for use in gas turbines is continuing. We have obtained much information from this program regarding the various high temperature alloys that would be suitable for gas turbines and also information concerning welding and fabrication of such alloys. Additional tests have been performed on the relaxation of the high temperature bolting materials and also the behavior of these materials in connection with seizure between the nut and bolt which is quite important at high temperatures. Oxidation characteristics have also been investigated.

We have not devoted any intensive work to the further development of the gas turbine locomotive itself other than what has been contained in our correspondence with you during the year. However, the above mentioned programs all are associated in detail, if not in the aggregate, with the locomotive unit and the progress being made on these programs is directly applicable to gas turbine locomotives.

The diligent study, research and actual construction of gas turbines by this large manufacturing company is certainly very encouraging, and we therefore believe that as soon as conditions will permit, applications of gas turbines to locomotives will be given serious consideration.

Locomotive Design

With the definite knowledge and assurance that a satisfactory design of gas turbine will be available when conditions will permit the construction of a locomotive with this type of prime mover, this committee has proceeded with the outline and preliminary design.

[The report included a table of dimensions and specifications of the locomotive which the committee now proposes. The total weight is 430,000 lb. It is carried on two six-wheel trucks, all of which are drivers; will develop a maximum starting tractive force at 90,000 lb. and develop a maximum of 6,000 hp. It will be equipped with four steam-heat boilers each with a capacity of 1,600 lb. of steam per hour. The drive will be through combined hydraulic torque converter and hydraulic coupling sets, one set for forward motion and one set for backward motion, provided at high and intermediate speeds with dynamic braking through the reverse hydraulic converter. Each section of the drive shaft will be fitted with two Bendix-Weiss rolling ball universal

joints, one of which in each pair will provide for end motion. The drive will be through hypoid gears and pinions which permit the drive shaft to pass over the axles. Designs of universal joints for the locomotive are being developed by the Bendix Corporation; the hypoid gears by the Gleason Works, Rochester, N. Y.; roller bearings for the axle journals by the Timken Roller Bearing Company, and the combined hydraulic torque converter and coupling sets by the Hydraulic Coupling Division of the American Blower Corporation, Detroit, Mich. Designs for the six-wheel trucks are being developed by the General Steel Castings Corp.—EDITOR.]

Universal Joints for Mechanical Drive

A very important detail of the transmission of power from the gas turbine, to the driving axles and wheels, is the universal joints in the driving shaft. A thorough research was made of the old Cardan two jaw four pin type design of universals, but of the more recent construction with friction, anti-friction and rubber pin bearings. None of these designs, however, seemed to meet all the requirements for heavy duty and comparatively high speed transmission of 3,000 hp. and shaft r. p. m. up to over 1,800 at a maximum speed of 120 m. p. h.

The plain and anti-friction bearings for the pins on these designs would be difficult to lubricate definitely and positively under all conditions and there has been insufficient experience in actual service with rubber universal joints to transmit the horse power and provide the starting torque for the locomotive under consideration.

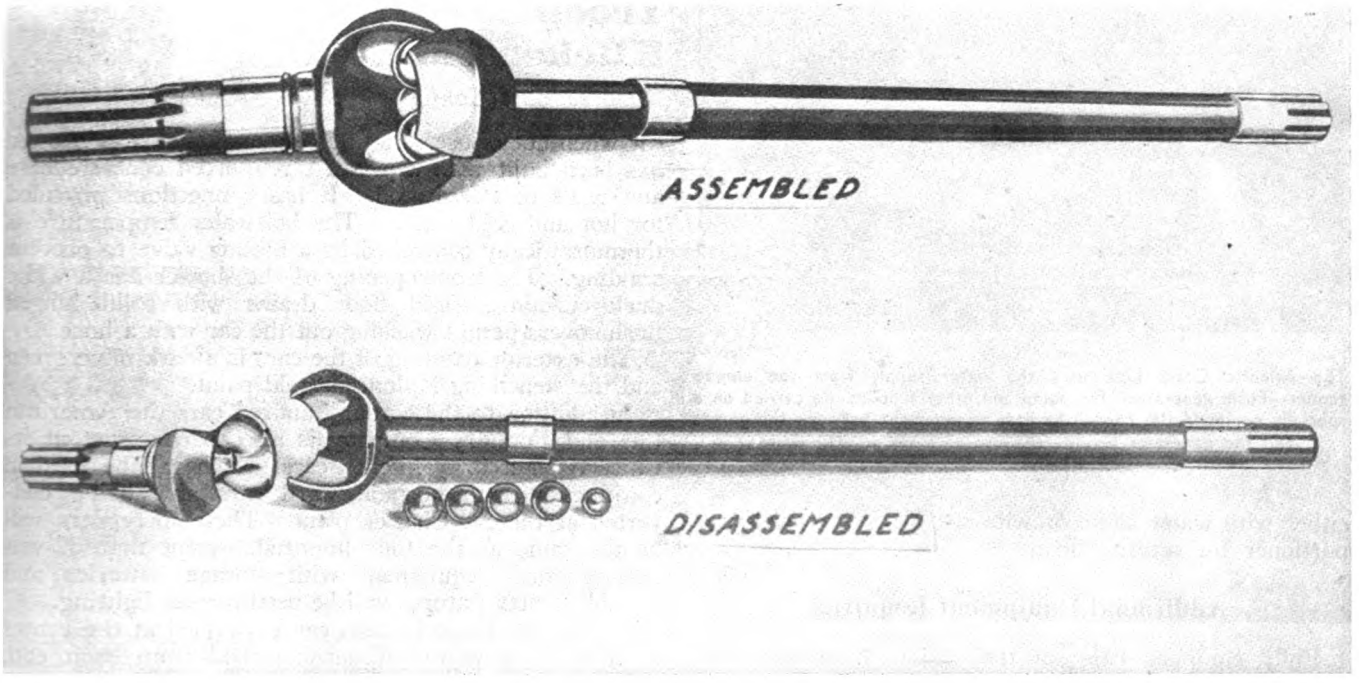
During this research, it was found that there is a rolling ball universal joint which has recently been developed and is being manufactured by the Bendix-Products Division of the Bendix Aviation Corporation, South Bend, Ind.

The Bendix-Weiss rolling ball universal joint is extremely simple and transmits an absolutely uniform velocity from driving to driven shafts at any angular position of one shaft with respect to the other. The ordinary (Cardan) joint does not transmit a uniform velocity from the driving to the driven shaft. There is an acceleration and deceleration of speed twice per revolution, producing for a speed of 3,000 r. p. m., for instance, 12,000 changes in speed per minute in the driven shaft velocity.

The constant velocity feature of the Bendix-Weiss joint is secured by maintaining the plane of driving engagement between the two yokes at half the shaft angle. Steel balls are placed in non-concentric intersecting races cut in the yokes. Without any ball retainer or cage, or other forcible means, the races cause the balls to roll angularly one-half the distance traversed by the yoke.

Another great advantage of the joint lies in its ability to take end motion by allowing the balls to roll endwise in their races thus doing away with slip joints in the driving shafts. The balls roll with a small fraction of the effort required to slide a spline and a difficult place to lubricate is removed.

One railway application of the joint is its use in the streamlined cars (President's Conference street cars) which are in operation in Brooklyn, Pittsburgh, Chicago and elsewhere. Early housing designs for dust and lubrication seals were not durable but a new type has been perfected which on these cars provides for possibly 80,000 to 100,000 miles between inspection and lubrication periods, a medium grease being used in this service where driving shafts are direct connected to 55-hp. motors operating up to 4,200 to 4,500 r. p. m.



A typical Bendix-Weiss universal joint

The simple rugged construction of these universal joints and the exceptional service record they have made, coupled with their long wearing life, low lubrication costs and infrequent inspection requirements, should make them satisfactory for the heavy duty service required in the mechanical transmission for the turbine powered locomotive.

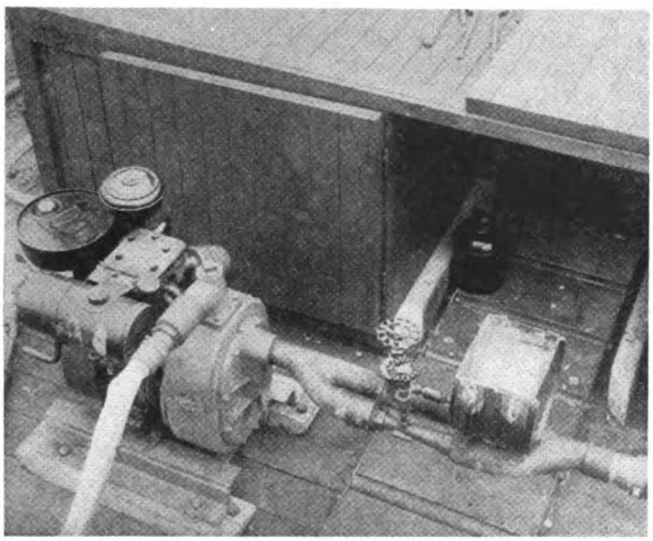
The Bendix Corporation's engineers are developing designs for the universal joints for transmitting the 3,000 hp. required for driving each of the two six-wheel trucks for the proposed 6,000-hp. locomotive.

The report was signed by L. P. Michael (chairman), chief mechanical engineer, C. & N. W.

Railroad Fire-Fighting Cars

(*Continued from page 578*)

on their cars and this amount is sufficient for over 200 minutes with two nozzles in operation. One gallon of the foam liquid with 19 gallons of water yields 350 gallons of foam at the nozzle. The liquid supply is carried in a knapsack over the shoulder of the operator using the playpipe. A variation of this system is used on the Atlantic Coast Line where the same liquid is employed on fire fighting cars. This road uses a proportioner at the pump to create the desired foam which is directed at the fire through a Phomaide playpipe. The A. C. L. uses the assisting locomotive's water supply or any other source which can be reached from the fire-car's location. A simple by-pass permits the pumping unit to be used



The Atlantic Coast Line uses the water supply from the engine tender—Foam gencrators, the pump and other supplies are carried on a specially equipped flat car—A by-pass arrangement between the pumps and the generator permits the use of foam or plain water

either with water alone or with the water-chemical proportioner for creating foam.

Additional Equipment Required

Fully equipped cars on the various railroads vary but little in their full complement of tools and supplies. Depending upon whether or not any portion of a railroad is electrified specialty tools such as wire cutters may be carried but, in general, the two factors which make for minor variations in equipment are the type of foam producer employed and the source from which pressure is obtained, whether gas or steam engines or direct locomotive connections. Hose is generally carried in 50-ft. lengths with 600 ft. of 2½ in. dia. and 600 ft. 1½ in. dia. considered as an adequate supply of this item. This is supplemented with suction hose which is used where a stream, pond or other open source of water supply can be drawn upon to replenish or supplement that in special tanks or the locomotive tenders. Strainers for use with the suction hose are necessary to insure as clear a supply of water as possible. The fire hose is carried on reels from which it can be run off rapidy; the suction hose is carried on a rack from which it is easily removed. Nozzles of various types, adapters and wrenches of several sizes are required to complete the hose equipment.

Asbestos suits and gloves, fire shields, firemen's helmets, face shields, rubber coats and boots and gas masks are carried for the personal protection of the firefighters. A first aid kit and a special kit for the treatment of burns are considered essential. Fire axes, pike poles, crow bars and claw tools serve many useful purposes and are to be found in most cars. Electric lanterns and floodlights are as important on these cars as they are on regular wreck-train equipment.

Effectiveness in Service

Only one road has reported actual service experience with their fire-fighting equipment. In this instance an oil fire in a car yard was effectively combatted in conjunction with apparatus from a municipal fire department. Other roads have, however, conducted tests to determine the efficiency of their equipment and to train their men in its use. All have reported satisfactory results in combatting fires intended to approximate those it is anticipated may be encountered.

Troop Kitchen Cars

(*Continued from page 580*)

car when out of use. In one corner of the car a shower has been built with a pre-cast reinforced concrete base and walls of Presdwood. It has connections provided for hot and cold water. The hot-water temperature is thermostatically controlled by a mixing valve to prevent scalding. The front opening of the shower has a white duck curtain. Eight floor drains with solid hinged flush covers permit washing out the car with a hose.

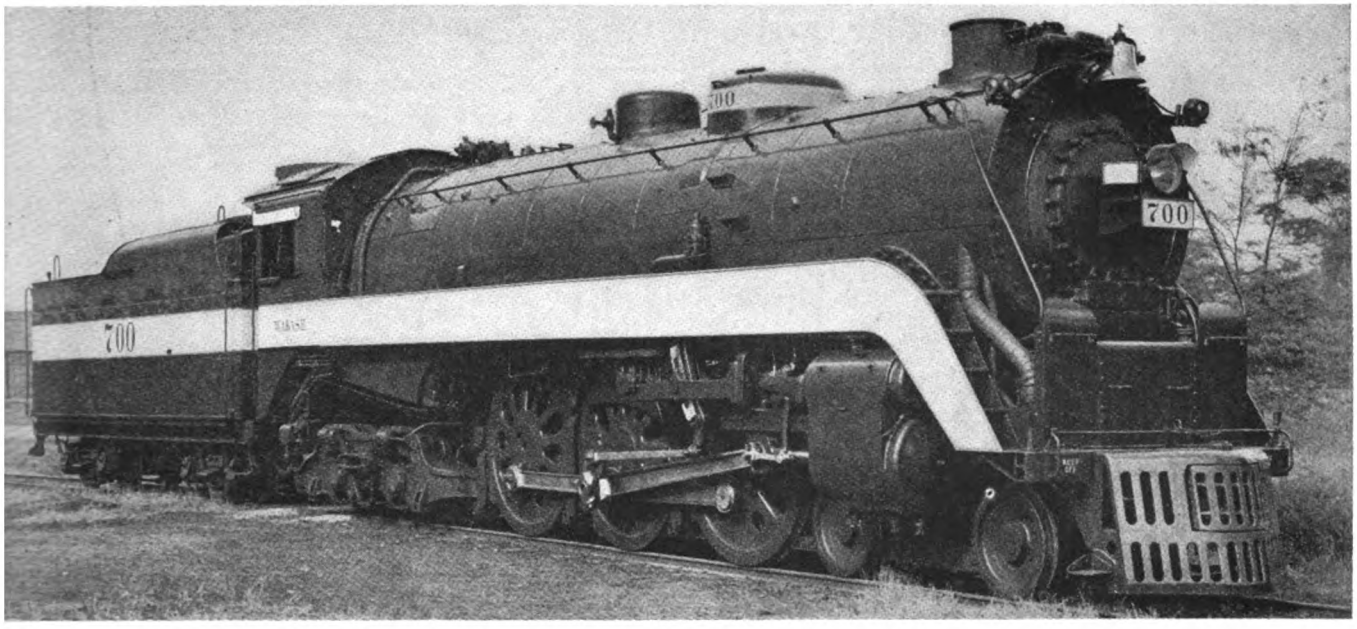
The exterior painting of the cars is a dark olive green and the stencilling is done in gold paint.

In addition to these four hundred cars the American Car and Foundry Company is also to construct at its Chicago plant forty kitchen cars, which will be used in conjunction with hospital ward cars now being converted at the St. Charles plant. These forty cars will be the same as the four hundred, except that 32-volt axle-generator equipment with storage batteries and suitable center fixtures will be used for car lighting.

In use, the troop kitchen car is coupled at the center of a train to permit dispensing food from each end. Each car can furnish meals for 250 men. The cars will be stocked with food, and with kitchen utensils, by unit mess sergeants. Each unit employing the car will provide its own cook and crew. Aside from the cooking utensils, all equipment is stationary.

At mealtimes men are issued paper cups and plates. Bread and cubes of butter are served from paper cartons. The entree is carried in stock pots by two men, with a third following to serve it as the trio proceeds through the train aisles. Coffee and dessert are served in similar fashion. After the meal is finished, a kitchen police crew gathers up every bit of debris, which is burned at the first opportunity.

These cars, which are being built at the rate of 30 per week, will release for commercial service many of the baggage cars which have been in use as make-shift kitchen cars since heavy movements of troops began. Many of these cars will be released in time for the transportation of mail and express during the holiday season.



4-6-4 type passenger-freight locomotive turned out at Decatur shops

Three-Cylinder Power Rebuilt as

Freight-Passenger Locomotives

Wabash converts 2-8-2 locomotives to modern 4-6-4 type for use in high-speed heavy-duty freight or passenger service—Have cast-steel beds

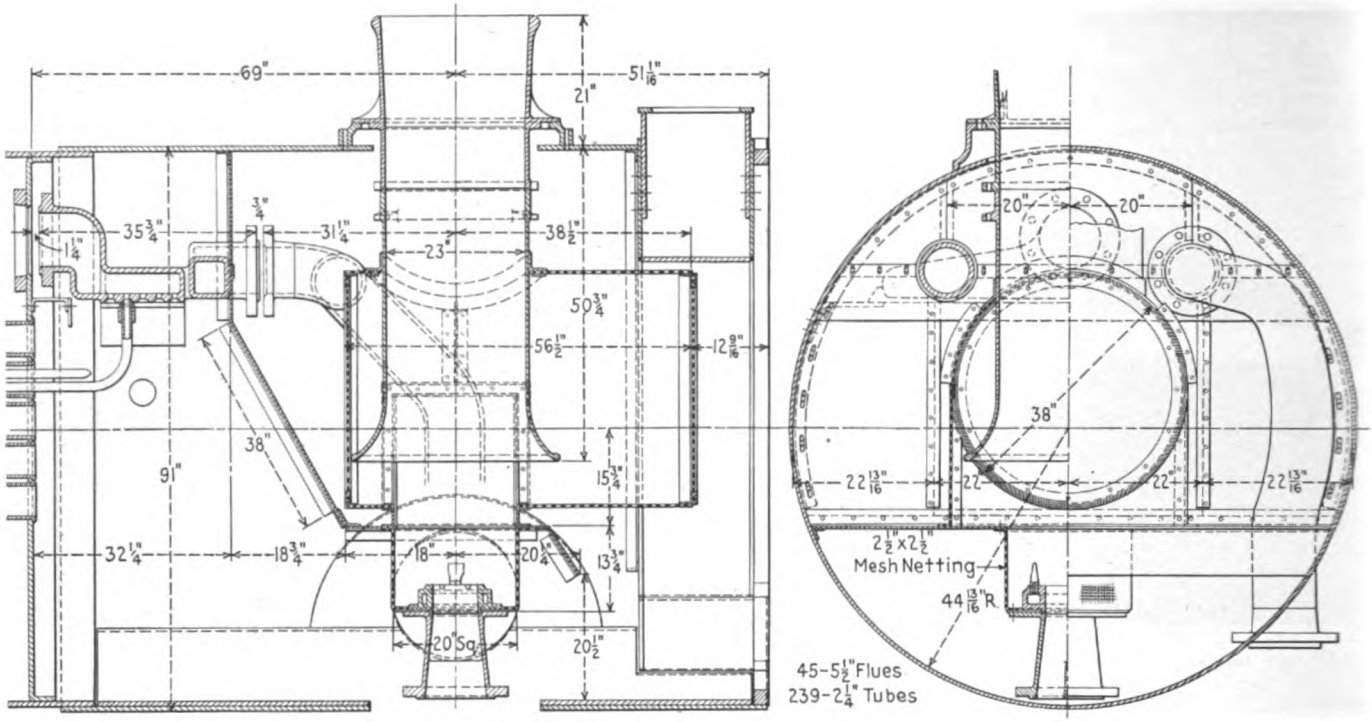
FIVE three-cylinder freight locomotives with a 2-8-2 wheel arrangement built in 1925 for the Wabash by the American Locomotive Company have recently been converted at the railroad's Decatur shops into 4-6-4 type locomotives intended for either heavy fast passenger or fast freight service. These locomotives were a part of an order of 50 built in 1925, 45 of which were of the two-cylinder type, which have gradually been returned to service as general repairs were completed after they had been set aside during the years when traffic demands for heavy freight power were at a minimum. The design of the three-cylinder locomotives was such that they were not adaptable to heavy freight service at the speeds now required and it was, therefore, determined that they should be rebuilt.

The boilers of the five locomotives were in good condition and had a steam capacity 48 per cent greater than that of the existing Wabash class J-1 Pacific-type passenger power. They have 40-in. combustion chambers and are fitted with 45-unit Type A superheaters. New steel locomotive bed castings were ordered and the boilers and cabs applied to them. Other details were also changed and appliances added to complete the modernization and assure economical operation.

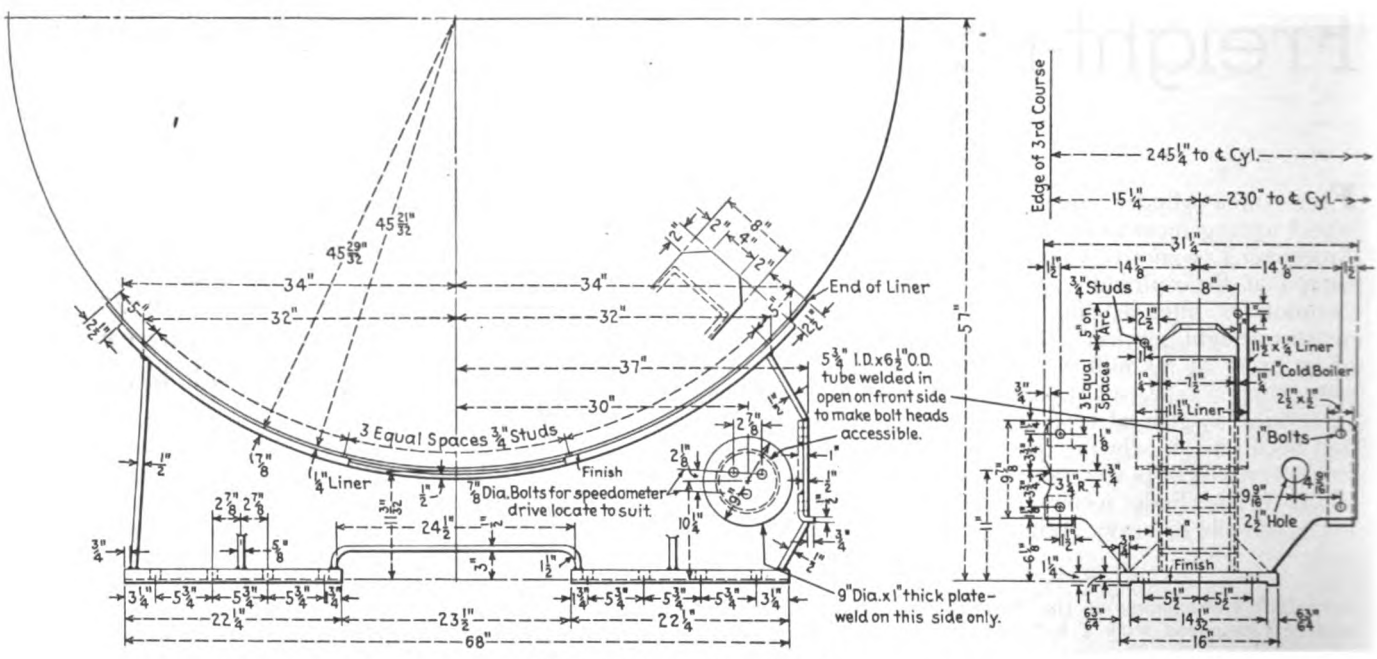
The engine bed has cast integral with it the cylinders and back cylinder heads, with a high cylinder saddle and inside steam pipes, and the main air reservoir. Brackets are cast at the front for the air compressor and feed-water-heater hot-water pump, and there is a bracket cast at the rear on the left side for the application of the stoker engine. The engine truck is of a special cast-steel design with hardened spring-steel pedestal liners and wear plates at the roller centering device. Coil springs are used in the truck to carry 70 per cent of the weight with the other 30 per cent carried by semi-elliptic springs. Trailer-truck brakes are used and the brake cylinders and rigging are accessible from the outside.

Principal Dimensions of the New Wabash Class P-1 Locomotive Compared with a K-5 (3-cylinder) and a J-1 (4-6-2) Passenger Locomotive

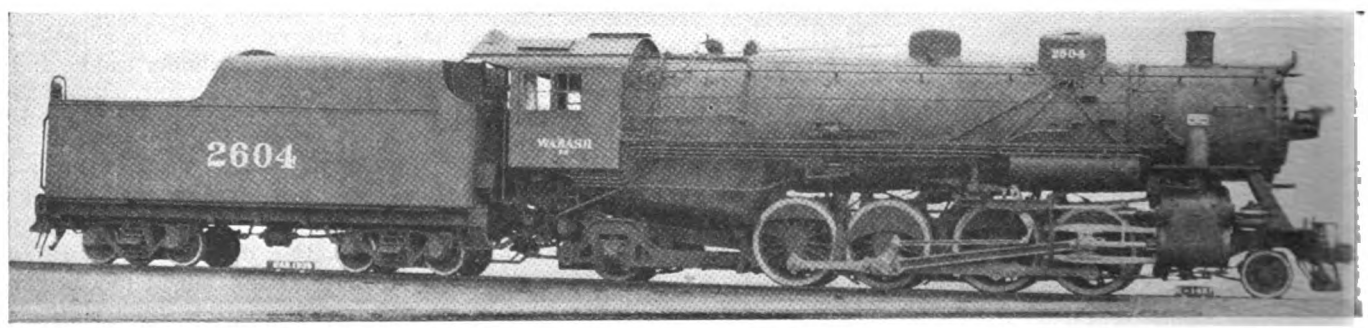
	P-1	K-5	J-1
Type	4-6-4	2-8-2	4-6-2
Boiler pressure, lb.	220	210	215
Cylinders, diameter and stroke, in.	26 x 28	2-23 x 32 1-23 x 28	24 x 26
Diameters of drivers, in.	80	64	74
Tractive force, lb.	44,200	67,869	36,984
Factor of adhesion	4.44	3.76	4.20
Total weight of engine, lb.	374,690	340,490	248,840
Weight of drivers, lb.	196,390	251,215	155,140
Wheel base, engine, ft.-in.	40—7	39—1	34—0
Wheel base, engine and tender, ft.-in.	75—5½	73—9½	66—5⅞
Overall length, ft.-in.	87—5	83—10½	76—7⅝
Tender capacity:			
Coal, tons	16	18	11½
Water, gals.	12,000	10,000	8,800
Boiler dia. 1st. course inside, in.	88	88	68¾
Firebox length, inside, in.	121⅜	121⅜	108⅛
Firebox width, inside, in.	84¼	84¼	84¼
Grate areas, sq. ft.	70.9	70.9	63
Heating surface, total evaporative, sq. ft.	4,225	4,225	3,310
Heating surface, superheater, sq. ft.	1,051	1,051	740
Heating surface, total equivalent, sq. ft.	5,801	5,801	4,420
Piston valve diameter, in.	12	12	12
Valve travel, in.	8	6½	6½



The front end arrangement is designed to aid in efficient drafting



Details of the waist sheet saddle



Original Wabash K-5 three-cylinder locomotive built in 1925 by the American Locomotive Company

New Materials and Equipment on the P-1 Locomotive Not on the Original K-5 Locomotive

Locomotive bed frame, engine truck, trailer truck, Boxpok driving—wheel centers, swing coupler pilot	General Steel Castings Corporation, Eddystone, Pa.
Roller bearings, all locomotive wheels	Timken Roller Bearing Company, Canton, Ohio
Needle bearings, valve motion	Pilliod Company, New York
Feedwater heater 4½ S.A.	Worthington Pump and Machinery Corporation, Harrison, N. J.
Mechanical lubricators	Detroit Lubricator Company, Detroit, Mich.
Stoker, H.D.	The Standard Stoker Company, Inc., New York
Air brakes, No. 8 ET	Westinghouse Air Brake Company, Wilmerding, Pa.
Radial buffer, Type E2	Franklin Railway Supply Company, Inc., New York
Foameter	Electro-Chemical Engineering Corporation, Chicago
Cylinder protection valves	The Prime Manufacturing Company, Milwaukee, Wis.
Grates, 12-in. Tuyere type	Hulson Grate Company, Keokuk, Ia.
Speed recorder	Chicago Pneumatic Tool Company, Chicago
Cast air radiation elements	Wilson Engineering Corporation, Chicago
Injector, Type S.R.	William Sellers & Co., Inc., Philadelphia, Pa.
Cylinder packing	The Locomotive Finished Material Company, Atchison, Kan.
Driver brake beams—Widdicombe	Sivyer Steel Casting Co., Milwaukee, Wis.

The main wheels are cross-counterbalanced and carry 120 lb. overbalance. The weights of primary and secondary balances were carefully calculated with consideration given to the differing effects of the right and left eccentric rods and cranks. Total overbalance per side is 420 lb. which amounts to 28 per cent of the reciprocating weights. The front and back wheels are statically balanced for rotating weights and each carries 150 lb. overbalance. The dynamic augment at diametral speed of 80 m. p. h. is 5,400 lb. for the main wheels and 6,700 lb. for the front and back wheels.

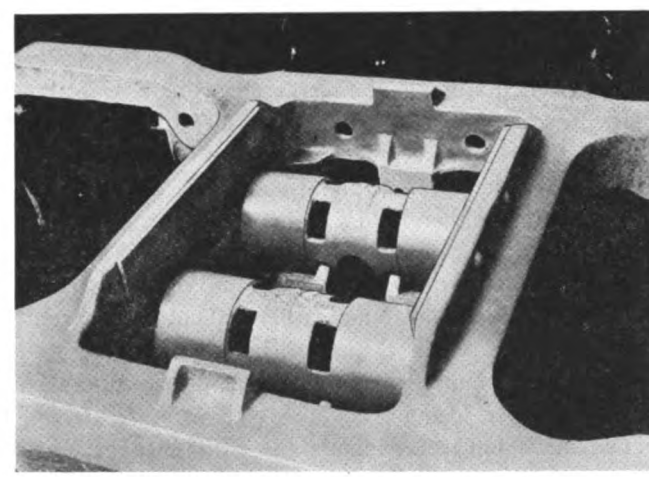
Driving wheels on the rebuilt locomotives are 80 in. in diameter as compared with the 64 in. wheels used formerly and 74 in. for the class J-1 passenger locomotives; tractive force is 44,200 lb., compared with 36,984 lb. for the class J-1. The design of the locomotive permits it to operate on maximum curves of 20 deg., or 288 ft, radius. Roller bearings are used on all drivers and on the engine and trailer trucks.

The Walschaert valve gear is used, with 12-in. piston valves which have 8 in. valve travel, and McGill needle bearings for the link-block, link-trunnion, link-foot and combination-lever bearings. Two 32-pint mechanical lubricators are installed. One furnishes valve oil to the main valves, cylinders, feedwater heater and guides; the other supplies car oil to the truck pedestals, shoe and wedge faces, valvestem crosshead guides, equalizer pins, expansion pads, cylinder center plate, trailer radius-bar center plate and the slide bearing at the back end of each valve-motion radius bar. The multiple bearing crosshead guides are supported from the cross-brace casting instead of from the guide yoke and back cylinder head.

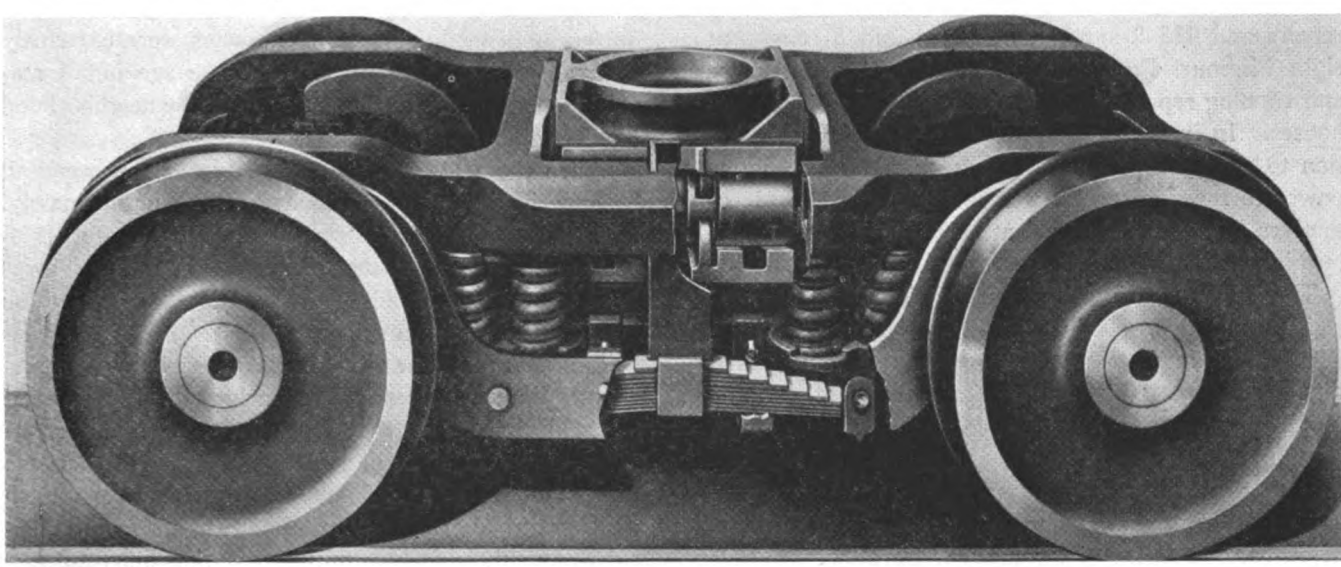
One sliding boiler support is placed between the cylinders and the rear expansion pad. This incorporates box-type welded construction and also serves as a power-reverse-gear bracket and speedometer-drive-wheel bracket. Main and side rods are of alloy steel and were made at the Decatur shops to the railroads design. Valve-motion parts were also made at the shops of low carbon steel. Well-rounded, streamlined steam and exhaust passages are a feature of the design. Exhaust passages average 14 per cent of the cylinder area in all sections between the main valves and the exhaust-stand base. A Master Mechanic's front end with a Goodfellow nozzle and a cylindrical box-type spark arrester is used.

The original tender as used on the three-cylinder type locomotives has been retained but its capacity was increased from 10,000 to 12,000 gal. by adding 16 in. of water space to the top of the tank and removing tool and supply boxes from the front water legs.

As rebuilt the five locomotives become the P-1 class on the Wabash.



Roller centering device of the engine truck



Cast-steel trucks have coil and semi-elliptic springs and a roller centering device

EDITORIALS

What Improvements Can Be Made?

Coupler and draft-gear failures constitute a disturbing cause of delays to freight shipments en route. The railroads are operating today under heavy handicaps. Yet every possible effort must be made to keep the cars and trains on the move. Head work, intelligent planning, and good strategy as to the disposal of available manpower and materials seem to be about the only recourse left. What can be done to insure better inspection and what can be done to keep the couplers and draft gear in prime condition so that they will not fail in service? Your letter must reach our New York office as promptly as possible and not later than December 15.

Maintenance Work Publicized

A news release recently given out by the Missouri Pacific is particularly interesting because of the effective method used to give the public some idea of the magnitude of the job of keeping locomotives in condition to handle heavy traffic on the Missouri Pacific and, by implication, on other roads. The 1,146 steam and 51 Diesel-electric locomotives on the Missouri Pacific, for example, are maintained by approximately 9,000 employees, which is an increase of about 5 per cent over last year, when 8,520,000 man-hours were expended on locomotive maintenance at an average cost of $10,000 per locomotive.

The news bulletin explains the difference between various classes of repairs in order to show how thoroughly organized this work is and explains that last year 304 locomotives were given Class 2 and 3 heavy repairs and 415 locomotives Class 4 and 5 repairs at eight Missouri Pacific shop points, light maintenance and running repairs being made at a total of 41 roundhouses. In handling the latter work, particular attention to speedy repairs and the quick return of motive power to revenue service was said to permit 100 locomotives a day to be turned at each of the two largest terminals of this road.

The bulletin included a general description of the rigid periodic inspections made in accordance with government regulations to assure safety and said that the effectiveness of heavy maintenance and running repair operations on the Missouri Pacific is indicated by the relatively small number of failures in proportion to the total mileage operated, last year, for example, the figures showing 151,000 miles per failure in 50,000,000 miles of locomotive operation.

The Missouri Pacific, in issuing this bulletin of specific factual information about its motive power maintenance and performance, is undoubtedly contributing to increased public appreciation of the magnitude of the maintenance job which railroads ordinarily do with little fuss, and which has become difficult now only because of the current shortages in manpower and materials.

Machinery Needs Can Now Be Filled

The outbreak of the war caught many industries unprepared as far as certain essential materials and supplies were concerned and, in this respect the railroads were no exception, particularly as regards machine tools and shop equipment. For several years the acquisitions of facilities of this character were extremely light with the result that the average age of all machine tools in railroad shops is now in the neighborhood of 25 years.

When the real pressure of wartime traffic began to be experienced by the railways it was, unfortunately, at a time when defense plants were in the process of being equipped and the machine-tool industry was buried under thousands of orders for tools for these plants and foreign customers.

Two years ago the situation in the machine-tool and shop-equipment industry was such that most railroad mechanical men felt that it was simply useless to attempt to buy that type of equipment and when the long-time deliveries of low-priority customers, such as the railroads were at that time, was taken into consideration, their feeling toward the possibility of getting machinery was probably not far wrong.

As the obsolete equipment in most railroad shops began to be put under load it became obvious that certain types of shop equipment would not deliver the output necessary to return motive power to road service in the required time and requests began to be made on machine tool builders for needed equipment. Within the past six to nine months the machine-tool industry has experienced a change and the job of equipping defense plants has been so well done that there is now opportunity to supply customers such as the railroads whose wants have been neglected.

Strange as it may seem, there were those in Washington who were not fully alive to the absolute necessity of seeing that the railroads got needed shop equipment and in all fairness it must be said that this was due in large part to the fact that railroad men themselves did not always bring it to the attention of the right people at the right time.

One of the most encouraging signs of recent weeks is that now, at a time when the machine tool and shop-equipment industry is rapidly finding itself in a more favorable position to take care of the needs of the railroads, there has been a growing appreciation on the part of government agencies of the vital importance of doing everything humanly possible to make sure that there is no failure of rail transportation. In fact, if railroad mechanical people will make known their wants in shop facilities every effort will probably be made to see that the needed equipment is given the most favorable delivery dates possible.

Further Improvements In Passenger-Car Design

Except for the inherent advantage of air transport from the point of view of high speed between terminals and private motor cars for convenient individual travel, the railways have a decided edge over other forms of passenger transportation and will doubtless capitalize these advantages to the full in meeting competition after the war. The indications point to a continuance of efforts, already notably successful, to produce light-weight equipment adapted to high speed-service which assures maximum comfort, convenience, pleasure and safety at low unit cost per passenger.

The amount of new passenger equipment normally required by the railroads in a given period depends upon the volume of traffic to be handled, efficiency of car use and the number of cars already available, as influenced by the preceding excess of new installations over retirements, or the reverse as has been the case on American railroads in recent years. Railroad passenger traffic cannot be expected to remain at its present high level after the war, but the rapidity with which present equipment is being worn out, the high percentage of older out-moded cars now in service and the announced intention of railway executives to make a serious bid for post-war passenger business indicate that several thousand new passenger cars will be ordered and built to meet the requirements of the railroads during the first few years immediately after the conclusion of hostilities.

As regards probable trends in design, further improvements in details and more efficient space utilization are anticipated, with little important reduction in car weights. The basic engineering and fabrication of light-weight car body structures, made of high-strength steels and aluminum, are pretty well developed and no revolutionary changes are in sight. The shell weight of a passenger car is much smaller in proportion to total car weight than commonly supposed and there is little chance for important weight savings except in car accessories, interior equipment, trucks, etc. In connection with the last named, the demand for still greater ease of riding may necessitate adding special equipment to trucks which will tend to offset some of the weight savings which may be effected by refinements in design and the use of stronger structural materials.

One of the achievements of railroads in a time when new passenger equipment could not be acquired, has been the adaptation of older cars by relatively slight changes in interior design to meet special requirements including military purposes. Large numbers of old Pullman cars and railroad parlor cars, for example, have been converted into hospital cars, troop sleepers, coaches, etc. Lounge cars as well as express cars have been rebuilt to give additional diner capacity. The conversion of this equipment, admittedly only a temporary expedient to meet emergency needs, simply serves to emphasize the present deficiency of the present supply of passenger-carrying cars, particularly modern types. Lessons now being learned in the operation and service performance of passenger equipment of all types, including these converted cars, will no doubt serve as a basis to which the design of the passenger cars of the future will have to conform.

Observance of Loading Rules

The Committee on Loading Rules of the Car Department Officers' Association made comparatively few suggestions in this year's report for changes in or additions to the existing rules. In submitting its report, however, it did say that, "We believe that if all concerned will put forth every effort to furnish shippers with advice and instruction, to the end that full compliance with the loading rules will be met, a considerable reduction can be made in the number of loads shopped for adjustment." The statement recognizes indirectly that there are at present too many instances in which loads are being accepted for movement from

shippers' sidings which are not loaded in compliance with the rules. It further recognizes that there might be an excuse for a shipper's lack of understanding of the requirements for safe movement and that the duty of familiarizing them with these requirements rests upon responsible railroad employees.

Within the past several years we have experienced not only a tremendous increase in the volume of freight traffic but also a marked change in the character of much of the material moved. Certainly, landing barges, tanks, artillery pieces, jeeps and other implements of modern warfare were new to railroads and their loading required study. It can be said that the problems met were overcome and, in most instances, manufacturers and representatives of the various branches of the service have cooperated in following safe loading practices. But there have been many instances where, either deliberately or because of misunderstanding, shippers have failed properly to secure open-top loads or to brace house-car loads properly. The failure to provide inside box-car door protection has been especially common.

Once these loads were in possession of the roads with proper billing issued they also became potential sources for sideswipes, wrecks and other accidents, as well as for damage claims. At the very least they were responsible for the loss of many precious man hours required for adjustments or transfers of loads if the condition was discovered before an accident occurred or the lading suffered any damage. It is evident, then, that every improperly loaded car which is accepted for movement represents a prospective out-of-pocket expense to the railroad and a delay to or the possible loss of the shipment itself.

The Committee might have pointed out that the "all concerned" were primarily car-department foremen, supervisors and inspectors. Cooperative agents are helpful but the responsibility for determining a car's fitness for movement rests with the car inspectors. Overworked as they are it is not surprising that some mistakes are made but overwork must not be made the excuse for perpetuating a possible dangerous situation. Education of shippers will certainly help but does not relieve the mechanical department of its responsibility. Then too, the inspector's right to refuse a car for movement can be a valuable, sometimes expensive, educational aid when dealing with recalcitrant shippers.

Traction Motor Maintenance

All Diesel-electric locomotives must meet the same daily, monthly and annual inspection requirements. The facilities for making the inspections and the methods of procedure vary with the locality, the type of locomotives serviced and the opinions and ideas of the men in charge of the work. These differences are not surprising for as one shop operator put it, "A year ago we were green as a gourd."

On the question of general overhaul there is little unanimity of opinion. Some railroads feel that regular general overhaul periods should be established and others plan on keeping locomotives working for indefinite periods at remote points, the necessary replacements being made with new parts or with parts which have been reconditioned in the railroad's or the manufacturer's shop.

Requirements of the traction motors and of other motors and generators on the locomotives have probably received the least attention. This can be ascribed to the fact that Diesel-electric locomotives have not been in service many years; that most roads have had little experience with electric traction motors, and that on switching power which is the most widely used type of Diesel-electric locomotive, the wear and tear on motors is relatively small and they will operate over long periods before major repairs are needed.

The motor repair situation is beginning to overtake some railroads operating road power. Electric motors and generators can be rewound and otherwise overhauled in the railroad shops, in the service shops of the locomotive builders, or in the shop of coil manufacturers. When the railroad does the work, it is customary to purchase ready-made coils. Present difficulties arise from several sources. The number of locomotives is increasing. The age of those in service is such that a considerable percentage of the motors are no longer new. War demands require that all equipment work long hours at or near capacity with the result that service shops which do rewinding are loaded to capacity. It has become necessary for at least one manufacturer to withdraw its offer to recondition Diesel-electric locomotive motors and generators.

Railroads with electrified sections having long experience in reconditioning traction motors and generators have shop facilities of their own. Such railroad shops have been doing as much work as possible and the overflow has gone out to manufacturer's service shops. These shops are now loaded with axle generators and shop motors in addition to traction equipment and there is need for an increase of facilities for doing this work.

Some railroads like to send this work out to service shops which have all the necessary facilities and the "know-how." Others prefer to keep this work as much as possible under their own control. This is particularly true of those having shops at some distance from outside service repair points. But traction-motor repair requires shop equipment not owned by most railroads. In addition to winding stands, baking ovens, dipping tanks, etc., the shop should have a balancing machine, and it may prove desirable to have facilities for seasoning commutators. In nearly all cases it is a growing situation which is going to need some consideration.

With the Car Foremen and Inspectors

Use and Maintenance of

Friction Draft Gears*

By J. M. Hall †

THERE are approximately 1,700,000 serviceable freight cars in the United States today, over 85 per cent of them are equipped with friction draft gears. There are 12 certified friction draft gears for freight cars on the market besides other friction gears intended for special service on locomotives, cabooses, ore cars, and passenger cars. Friction draft gears are used at nearly all couplings to protect train lines and equipment against high stresses which develop in ordinary handling of equipment.

The first draft gears were small springs which were satisfactory until the automatic coupler and air brakes were perfected and steel car construction introduced. Air brakes increased the speed possible in operating trains and larger locomotives made possible the operation of longer trains at higher speeds. These changes developed a need for a draft gear with more capacity and less recoil. It was found impractical to increase the capacity of the spring draft gear so as to have sufficient closing capacity as this would result in entirely too much recoil. A spring will kick back or recoil with practically the same force as is applied to it. A coil spring is satisfactory for cushioning a shock but the question is what to do with the energy after cushioning. The energy of the shocks still remains somewhere in the moving bodies after cushioning if it is not absorbed by some means.

In order to have a device which would offer a high cushioning capacity in closing, together with a kick back or recoil which would be low enough so as to allow smooth air-brake applications, the friction draft gear was designed. The first patent in the friction draft gear class was issued to George Westinghouse, Jr. in 1888. Mr. Westinghouse conceived the need of a friction gear to overcome the recoil of coil springs which caused parting of trains. Friction draft gears of today have a cushioning value of around 450,000 lb. with an absorption of from 75 to 98 per cent.

The Problem of Draft-Gear Travel

The purpose of any draft gear is to cushion, absorb and distribute the force between colliding cars or equalize the speed of moving cars in coupled or uncoupled conditions. The draft-gear travel multiplied by its average resistance is the capacity of the gear which is rated in ft.-lb. The ft.-lb. capacity can also be measured by a drop hammer. Capacity determines the volume of a shock which can be imposed at the coupling without going into over solid blows. The resistance offered by the draft gear at the coupling is the force applied to the car at the coupling. If sufficient shock is applied and the capacity of the draft gear is exceeded, the travel is then limited to the spring of the underframe with a rapid rise in resistance of sill pressure, which, of course, will cause failure if carried beyond the strength of the attachments or underframe.

A short travel with a high resistance has its advantages in some cases while a long travel and a lower resistance also has advantages and disadvantages. Many friction draft gears built with long travels have some advantages; however, experience and evolution over the past 40 years has resulted in a draft gear travel of 2⅝ in. to 2¾ in. It is evident that the longer the draft gear travel, the less will be the required resistance or force required to absorb a shock of the same magnitude. There are, however, many objections to a long travel gear. Car construction, train operations, and capacity have a definite relation to travel.

If a draft gear offers a resistance of over 450,000 lb., it will exceed the strength of the coupler shank, resulting in a shortening of the shank before the gear closure is reached. It is possible to obtain friction draft gears today with 2¾-in. travel which will allow all freight cars to be switched without closing the draft gears or causing damage at speeds up to 5 m. p. h. Exceptions are 90- and 120-ton cars. These cars require a longer draft gear travel if the force on the sills is not to exceed 450,000 lb.

Tests have shown that A. A. R. sills and attachments will start to distort when 555,000 to 600,000 lb. pressure is applied repeatedly. Therefore, if a draft gear is applied which has greater over-solid strength than the sills and attachments, repairs will be confined to coupler, sills and car structure. High over-solid capacity protects the draft gear but not the car. However, present-day car structures will resist many over-solid blows without failure.

There are three ways of cushioning and absorbing the energy of shocks at the coupling of freight cars; through the draft gear, in the car structure, and with the lading and car structure working together. There is no doubt but that the use of the draft gear is the economical way. If you are going to depend on the draft gear and not

* Paper presented before the Eastern Car Foreman's Association of New York on Nov. 12, 1943.

† Vice-president, Cardwell Westinghouse Company, Chicago.

the car structure or its lading you are faced with the necessity of using modern draft gears and draft-gear attachments in fairly good condition.

Good Gears vs. Bad Cars

It is considerably more economical to have draft gears in good condition rather than make repairs to the car structure and pay damage claims. Draft-gear manufacturers have continually improved the materials used in their construction to reduce draft gear maintenance costs. There are many thousands of friction draft gears in extensive service today which have required no maintenance and which will offer maximum car protection for many more years.

If forces high enough to cause failure in the underframe or car structure are reached by impacts above the gear's capacity damage claims will follow. These forces are obtained and cannot be eliminated in ordinary operations and switching speeds if low capacity draft gears are used. There is, however, a value in using a modern friction gear in a coupling with an old or obsolete type of gear. The total force developed at the coupling is the same on each car with, of course, the total available protection reduced at the coupling. In effect the modern friction draft gear offers considerable protection to the car in series at the coupling. Instructions as to maximum switching speeds can be issued, but satisfactory results will not be forthcoming. Cars with a modern draft gear in good condition can be handled up to 5 m. p. h. at impact without damage to the car or lading, while cars with low-capacity obsolete draft gears will develop damage when handled at an impact speed of 2 m. p. h.

No. A. A. R. rules require draft gears to be maintained in capacity. Many of the old cars operated today are equipped with worn and obsolete-type gears and it is a problem to decide whether to replace these gears or maintain them in kind, especially so if the life expectancy of the cars is only a few years. Railroads have changed out a great many obsolete types of gears and draft attachments in past years with a definite proof that a saving results.

Brake equipment on a car is used to develop resistance and absorb the energy of a moving car, that is, to check speed or stop a car. It is necessary to maintain brake equipment in good condition to promote safety and prevent damage to cars, lading and property. The work required to stop a car from 5 m. p. h. is the same whether the work is done by a draft gear or the brake shoes. If the car is stopped by the brake shoes, many feet are required; if stopped by the draft gears, 2¾ in. travel of the gears must handle the same amount of work. No brake action can be had without imposing work on the draft gears, while work may be imposed on the draft gears without using the brakes, as in starting of trains, equalizing speeds of cars, switching, etc.

Draft-Gear Economics

It is reasonable to assume that a large saving can be made by the use of a high capacity draft gear. Modern friction draft gears show a low rate of wear in the gear itself and wear is no longer a major problem. Approximately $7.70 per car per year is spent to maintain air brakes, including the replacement of brake shoes. Air brake equipment is periodically inspected and tested. Without this inspection the cost of repairs per car per year would be greatly increased. Considerably less than this amount is expended on repairing draft gears and attachments. It is not unreasonable to believe that a saving of from $30.00 to $40.00 per car per year is had by modernizing and maintaining friction draft gears. If we use the figure of $100.00 per car per year as an average repair cost and $45.00 as resulting from natural wear and tear, which includes wheels, axles and journal bearings, painting, air brake maintenance, brake shoes, lubrication, car structure and miscellaneous, we have left $55.00 per car per year to cover repairs due to shocks and unnatural wear and tear. A large percentage of this can be saved by using modern draft gears. Special attention is being given to draft-gear repairs today and the saving in repair expense has then been surprising, especially so when periodical repairs were made. Periodical inspections and repairs should be made to draft gears on average cars and made frequently on heavy rigid cars in intensive mileage service.

When periodical repairs are made, draft gears, pockets and attachments should be examined and removed if necessary, then repaired and checked before re-application to the cars. Couplers and draft-gear attachments should be checked and restored to nominal original dimensions. Draft gear manufacturers today will lend all assistance possible in any repair program you may develop.

Future draft gear problems will be solved and suitable gears made available as railroad requirements increase. The saving in car-repair expense has been surprisingly reduced, together with damage claims because of the use of friction draft gears. The A. A. R. draft gear committee is at this time studying draft gear specifications and this work, with cooperation from the manufacturers, will benefit the railroads to a large extent if gears are given reasonable attention after they are placed in service.

Discussion

In the discussion which followed the presentation of Mr. Hall's paper a number of the members present indicated their belief that the excessive slack now permitted in many gears was a matter of serious concern. Mr. Hall stated that the approved type gears would not exceed ½ in. in slack within the gear itself, any additional slack resulting from wear in related parts. This statement would, he said, not be true of obsolete or non-approved gears where the slack in the gear might exceed the figure which he had given.

Other members suggested that the A. A. R. should consider the adoption of a rule requiring periodic dropping and inspection of draft gears. The case of one railroad was cited which followed the practice of dropping gears every 18 months on its own equipment, stenciling the cars with the inspection dates. Although not indicating his opinion of the time interval for such inspections, Mr. Hall agreed that such a practice had merit and served frequently to disclose defects in gears and related parts not readily discovered in ordinary inspection.

The question was raised by a member as to the ease with which wear on gears could be determined on several types of gears. Mr. Hall replied that all certified gears could be measured with accuracy by a workman familiar with their construction. All manufacturers have provided measurement points which can be used to determine wear; loose parts also serve as indicators, he said.

All present were in agreement that the proper maintenance of draft gears and related parts was important in reducing damage to car structures and ladings and very important in its effect on reducing the likelihood of break-in-twos.

Conservation of Journal Bearings*

By R. B. Garren †

Prior to Pearl Harbor, the car department forces of the Illinois Central at Centralia, Ill., in an endeavor to create a better operating condition, started to trim journal brass with a mechanical brass trimmer. At the time, we had no thought in mind directly of conserving brass, our whole thought being to prevent hot boxes. However, as we got into the matter further, we found that this was actually saving brass, especially on system cars which we were repacking. When we found a brass that was run down on the sides far beyond the limits permitted by the rules, we trimmed this brass, returned it to the journal from which it was removed and definite checks showed that we got even better operating conditions than if we had put on a new brass. After we were thoroughly convinced in this regard, we extended it to our program repairs, trimming all brasses that showed the slightest indication of running down in the oil recess. Checks of several hundred cars proved that we were receiving excellent operating results from this method, as well as reducing materially the consumption of new brasses, either relined or new. Our saving on program work has averaged in excess of 30 per cent, which is a real item in a shop where 15 to 18 heavy repair cars are turned out daily.

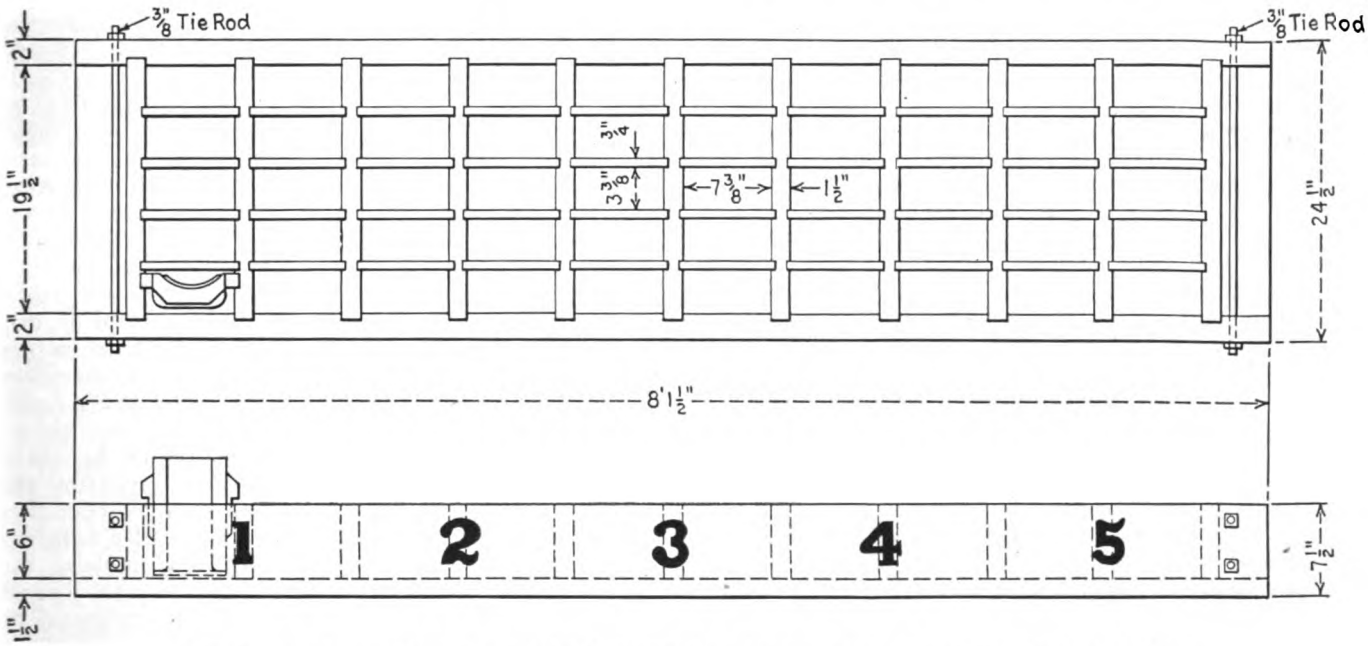
After Pearl Harbor, the whole phase of the brass situation was brought forcibly to our attention by our general officers, through appeals to every man in our employ to study thoroughly all phases of the brass situation, as well as all other vital metals. We secured additional trimmers, intensified our work in this regard and got into the whole matter more thoroughly. The matter of returning the brasses to service which were in good condition and which were removed from condemned wheels was taken up. After several attempts, trials and different methods of properly locating brasses after they were selected, we devised a brass container, made as shown in the drawing.

It consists of a solid, but shallow, lumber box, about 8 ft. long by 2 ft. wide by 7½ in. high, made mostly of 2-in. lumber and divided into 50 sections or slots so proportioned that each slot will accommodate one car brass standing on end. The first two short rows at one end of the box are designated No. 1 and succeeding pairs Nos. 2 to 5, inclusive, as indicated on the drawing, thus making storage space for 10 car brasses in each of five step sizes as shown in the accompanying table.

Step Sizes of Car Brasses for Each Bin Number

Normal capacity, lb.	Dimensions of Axle New, in.	No. 5, in.	No. 4, in.	No. 3, in.	No. 2, in.	No. 1, in.	Worn out, in.
80,000	5	4 15/16	4 14/16	4 13/16	4 12/16	4 11/16	4½
100,000	5½	5 7/16	5 6/16	5 5/16	5 4/16	5 3/16	5
140,000	6	5 15/16	5 14/16	5 13/16	5 12/16	5 11/16	5½

When a pair of wheels is condemned and removed from a car but the brasses are still serviceable, the journal diameter is measured with calipers, the brasses numbered in accordance with the table shown and inserted in the appropriate slots in the brass container where they are kept safely without danger of scoring or damaging the soft metal bearing surfaces until the brasses are needed for re-application to journals of the correct size.



Wooden container with separate slots for 50 individual car brasses, segregated in five different step sizes

Journal bearings are considered condemned when hammer tests show loose or broken lining; when the back or a lug is cracked or broken; when worn ¼ in. or more lengthwise at either end, or when the combined wear lengthwise from such cause is ⅜ in. or more; when the lining is worn through to the brass. When any of these conditions is found the brass is, of course, scrapped and no attempt made to give it a step size and use it again. All brasses are trimmed with a brass trimmer along the bottom edge of each side wall to restore the oil recess before the brasses are placed in service again.

As cars move on through the shop and trucks are dismantled, scrap wheels removed, and axles checked, truckmen before securing a new brass go to the brass container to see if a brass of proper measurement is available, and if so the salvaged brass is used. This

* Short paper presented at the September 21 meeting of the Car Department Association of St. Louis.

† Gang foreman, Illinois Central, Centralia, Ill.

has resulted in a large saving in the consumption of car brasses in our shop and definite checks of their operation have proved that they have given good results with practically no extra expense.

The carman who handles this job must be acquainted with all details and requirements of journal brasses when selecting them for further service. The men who handle the truck position must follow through to see that the brasses are applied to the journals that they are best suitable to operate on. We think enough of this plan that it will be continued after this war emergency and the shortage of critical material is over for the reason that these brasses are already worn in and they fit the journals to which they are applied and, in our experience, we find little or no run down of the metal in the oil recess as we do when new brasses are used.

When I speak of trimming brasses I do not have in mind a carman taking chisel and knocking out the metal that has run down in the oil recess but the placing of the brass in a precision machine built solely for this purpose and which is capable of performing an accurate mechanical job. In our experience, better operating results will be received and the life of journal brass will be materially extended by greater use of the brass trimmers when journal boxes are repacked, it being understood of course that in all cases serviceable brasses are returned to the journals from which they are removed.

Air Brake Questions and Answers

Installation and Maintenance of Axle Generators

227—*Q.—Describe the electric application and the automatic lap position.* A.—Brake pipe exhaust is closed. The drum connects all finger contacts, thereby closing battery wire (*3*) to release wire (*2*) and application wire (*1*). The *21-B* magnets are thereby operated to apply the brakes as described for electro-pneumatic service operation.

228—*Q.—Describe the automatic application position.* A.—This includes the last four notches, the first providing a service rate of brake pipe pressure reduction. Progressively faster reductions are obtained as the handle is moved to the right until an emergency rate is had in the extreme right hand or fourth position. The electric circuits remain connected for the complete movement. The extreme right-hand position should be used at all times for emergency applications for either electro-pneumatic or automatic operation.

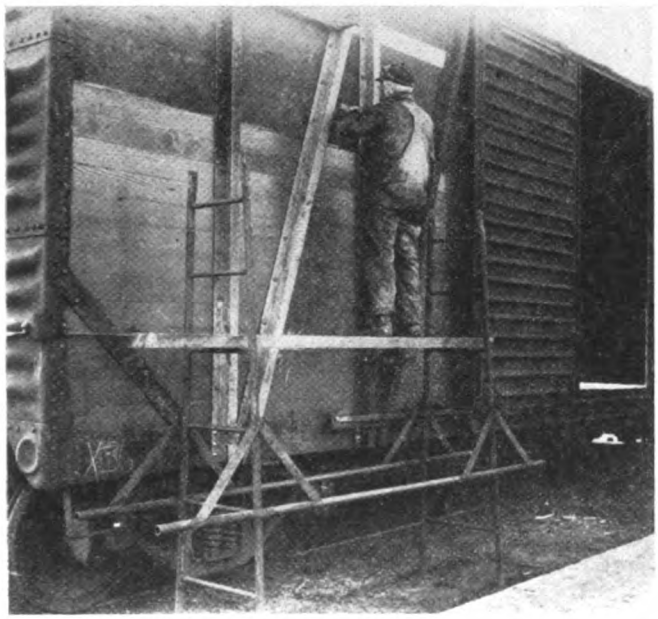
229—*Q.—With what is the A locomotive unit equipped?* A.—1—Air compressor, 2—main reservoirs with a 1-in. check value, 3—MS-40 combined automatic and self-lapping brake valve, 4—S-40-C independent brake valve, 5—type *H* filler, 6—E-7-A safety valves, 7—combined equalizing and reduction limiting reservoir, 8—M-3 feed valve, 9—M-3 reducing valve, 10—double heading cut-out cock, 11—electroc-pneumatic master controller, 12—No. 15-C double check valves, 13—No. 21-B magnet bracket, 14—D-22-ER control valve, 15—F-1864 relay valve, 16—combined displacement, auxiliary and emergency reservoir, 17—M-2 brake application valve, 18—"C-2" diaphragm cut-off valve, 19—"C" diaphragm foot valve, 20—½-in. choke fitting, (1/16-in. choke), 21—volume reservoir, 22⅜-in. check valve with choke, 23—B-1 sanding valve, 24—sanding reservoir, 25—⅜-in. check valve, 26—½-in. choke fitting, 27—C-1-20-8 strainer and check valve, 28—⅜in. cut-out cock, 29—F-1 automatic control switch, 30—condenser unit, 31—duplex air gages, 32—single pointer air gage, 33—brake cylinders with slack adjusters, 34—¾-in. by ¾-in. by ⅜-in. cut-out cocks, 35—½-in. ½-in. double cut-out cock, 36—B-3-A conductor's valve, and parts of the conventional train signal system, such as signal valve and whistle, C-1-3-6 strainer and check valve, and car discharge valve.

230—*Q.—Give the duties of these parts.* A.—As is known the purpose of the compressor is to supply compressed air for use with the air brake, alarm whistle, etc. The main reservoirs furnish storage for compressed air to provide an adequate air supply for the operation of the brake. A 1-in. check valve is located between the reservoirs to prevent loss of main reservoir pressure in case of main reservoir connecting pipe leakage. The MS-40 combined automatic and self-lapping brake valve is two distinct brake valves in one housing and operated with one handle over a common quadrant. A manually-operated shifter lever engages the handle shaft of the brake valve to be operated. One brake valve shaft provides electro-pneumatic service operation when the electric braking circuits are operative. The other brake valve shaft provides the conventional pneumatic brake operation for use with the high-speed equipment if, for any reason, the electric braking circuits are inoperative; also when the locomotive is used with standard steam road passenger equipment cars or with freight cars. Handle positions and operation are covered under "Operation of the Equipment." The S-40-C brake valve is a self-lapping type which provides for independent application and release of the locomotive brake. The type "H" filter is for the purpose of protecting the operating devices from dirt, and is located between the main reservoirs and these devices. The E-7-A safety valve limits the main reservoir pressure in event of the governor allowing a higher pressure than intended. There is one of these safety valves located in each compressor discharge pipe. The combined equalizing and reduction limiting reservoir operates with the MS-40 brake valve and the equalizing piston portion of the M-2 brake application valve to control the amount of brake pipe reduction in first service and service positions of the brake valve. The M-3 feed valve, set at 110 lb., regulates the pressure in the brake pipe and supplies air for operating various devices on the locomotive, and the M-3 reducing valve, set at 45 lb. regulates the pressure used for the signal system. The double heading cut-out cock, located beneath the MS-40 brake valve is for the purpose of cutting off the brake valve from the brake pipe and the control pipe in order to transfer control of the brake to another locomotive when assisting as the second locomotive of a double header or helper in the train. The electro-pneumatic master controller is a device which, in conjunction with magnet valves and relay valves installed throughout the train, relays to the brake cylinders the operation of the self-lapping unit of the MS-40 brake valve. One of the No. 15-C double check valves operates to connect the control pipe to the master controller in electro-pneumatic operation, or the emergency reservoir to the master controller in emergency brake application. The other check valve provides connection to the F-1 automatic control switch or similar device to operate the latter from the D-22-ER control valve during an emergency brake application and from the M-2 brake application valve during a safety control brake application. The 21-B magnet valve, as previously described, serves to control the pressure in the straight air pipe.

(*To be continued in a later issue.*)

Portable Scaffold

Typical of the labor-saving devices which may well be found in every progressive railway car shop and car repair point is the portable scaffold illustrated. This is an unusually lightweight, but rigid and strong design, used at the Decatur, Ill., car shops of the Wabash. It



Lightweight portable scaffold which is especially useful in connection with box car work at repair shops and rip tracks

comprises essentially welded tubular steel construction. The two uprights, or end ladders, are 8 ft. high and spaced 7 ft. apart, being tapered by rungs of varying length from about 18 in. at the bottom to 14 in. at the top. The spacing between rungs is also 14 in., so the foot board or platform can be easily placed at any one of six elevations whichever is most convenient for the work being done. Lateral stiffness is secured by welding 2 in. steel diagonal straps to the ladders and to the two horizontal 1¼-in. pipes which serve to space the ladders and extend beyond them, forming handles at a convenient elevation for carrying the scaffold.

Two men can easily move this scaffold any where desired about the car shop or repair tracks and this type of scaffold is of course most useful in connection with box car work.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Proper Terms Must Be Used In Reporting Wheels Scrapped

The Chicago & Eastern Illinois removed a pair of wrought-steel wheels from WCLX car No. 5563, replaced them with new cast-iron wheels and attached a defect card for the wrong repairs, reporting the removed wheels as one second-hand and the other scrap account worn hollow tread, remount gage. The Chicago, Rock Island & Pacific took exception to the charge for the difference in value between one second-hand and one scrap one-wear wrought-steel wheel because Rule 82 does not include one-wear wrought-steel wheels in referring to wheels to be condemned which take the tread-worn-hollow gage for remounting. The C. & E. I. refused to adjust the charge, claiming that its inspector had made an error in reporting and that the wheel was actually condemned because of a high flange.

In a decision rendered November 13, 1942, the Arbitration Committee said: "Billing repair card shows wheel scrapped account worn hollow tread remount gage, which term is not applicable to one-wear wrought-steel wheels. The contention of the Chicago, Rock Island & Pacific Railway is sustained." *Case No. 1794, Chicago & Eastern Illinois versus Chicago, Rock Island & Pacific.*

Disposition Must Be Requested For Usable Second-Hand Material Removed

The Western Maryland applied a new standard A. A. R. riveted wrought coupler yoke to SDRX car 3181 account vertical key slot type non-A.A.R. standard coupler body being defective and rendered a bill in accordance with Rule 101, Item 103. The coupler yoke and key were scrapped, although no defects on these parts were indicated. The parts were not held for owner nor was any disposition requested. The owner demanded second-hand credit under interpretation (C-2) of Rule 17. The Western Maryland disputes the claim on the ground that the rule specifies a "shall" instead of a "must" clause and it is, therefore, not mandatory for the repairing company to request disposition. The railroad stated that it was its general practice to request disposition but that it should not be penalized in this case because it had failed to do so.

In a decision rendered April 22, 1943, the Arbitration Committee sustained the position of the car owner in demanding second-hand credit.—*Case No. 1796, Sinclair Refining Company versus Western Maryland.*

Defect Card Determines Items For Which Billing Will Be Accepted

When repairing SHPX car 9992 the Texas & Pacific applied an L-5 Cardwell side member to a gear composed of L casings and G interior members. Subsequently it issued a defect card covering the replacement of a G-5 side member with the one in question. Later the owner billed the T. & P. for the value of a new gear which was later applied, and also for the labor of application. The Texas & Pacific disclaim responsibility for the material charge. Its contention was that billing could not include anything not covered by the defect card which it issued and that there was no proof that the later renewal of the gear was due to the repairs which it had made. The owner offered in evidence the statement of the gear manufacturer that the substitution made was ruinous for the entire gear and constituted wrong repairs for which the Texas & Pacific should reimburse it when it paid another company for the installation of a complete new gear.

The Arbitration Committee, on April 22, 1943, held that: "If defect card did not specify labor only, car owner may rebill labor and material for only such items as are specified thereon. The contention of car owner is not sustained."—*Case No. 1797, Texas & Pacific versus Shippers' Car Line.*

Material Charges Against "Labor Only" Defect Card Not Upheld

The Atchison, Topeka & Santa Fe removed a defective 20⅛-in. draft gear from PPCX car No. 1061 and substituted a 24⅝-in. gear. It issued a defect card for "labor only" and allowed a scrap credit for the two follower plates which were removed with the defective gear and not required in the application of the 24⅝-in. gear. The car owner corrected the repairs using a gear of the same type that had been removed and made a material charge for two follower plates which were required. The railroad claimed that a charge was not justified for material on a card limited to "labor only." Both parties cited the note following Item 277, Rule 101.

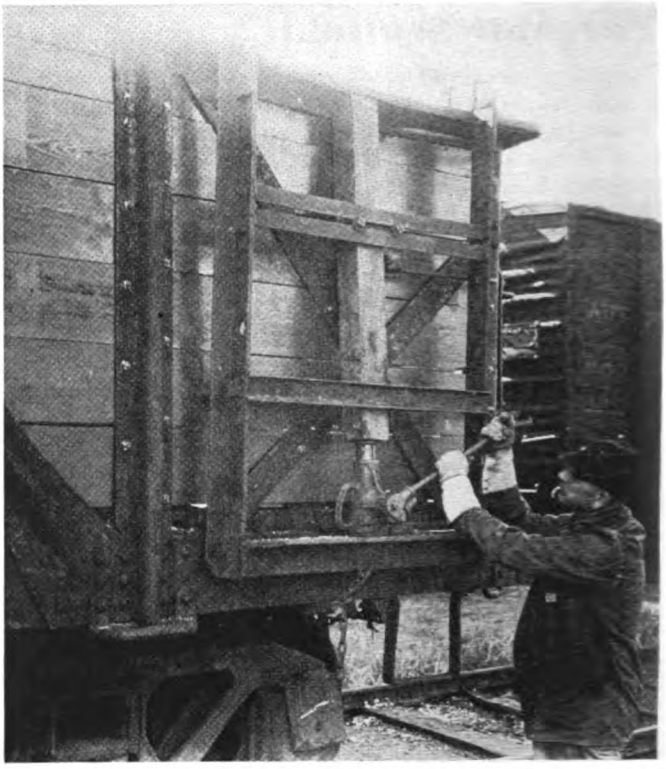
In a decision rendered April 22, 1943, the Arbitration Committee ruled that: "Inasmuch as defect card was properly issued for labor only, the billing should be accordingly. The contention of the Atchison, Topeka & Santa Fe is sustained."—*Case No. 1798, Atchison, Topeka & Santa Fe versus Mather Stock Car Company.*

Bulb Angle Straightener

The top bulb angles of gondolas and hopper cars are frequently bent owing to misuse with car-loading machines. A device which helps in straightening these angles at the Decatur, Ill., shops of the Wabash is illustrated.

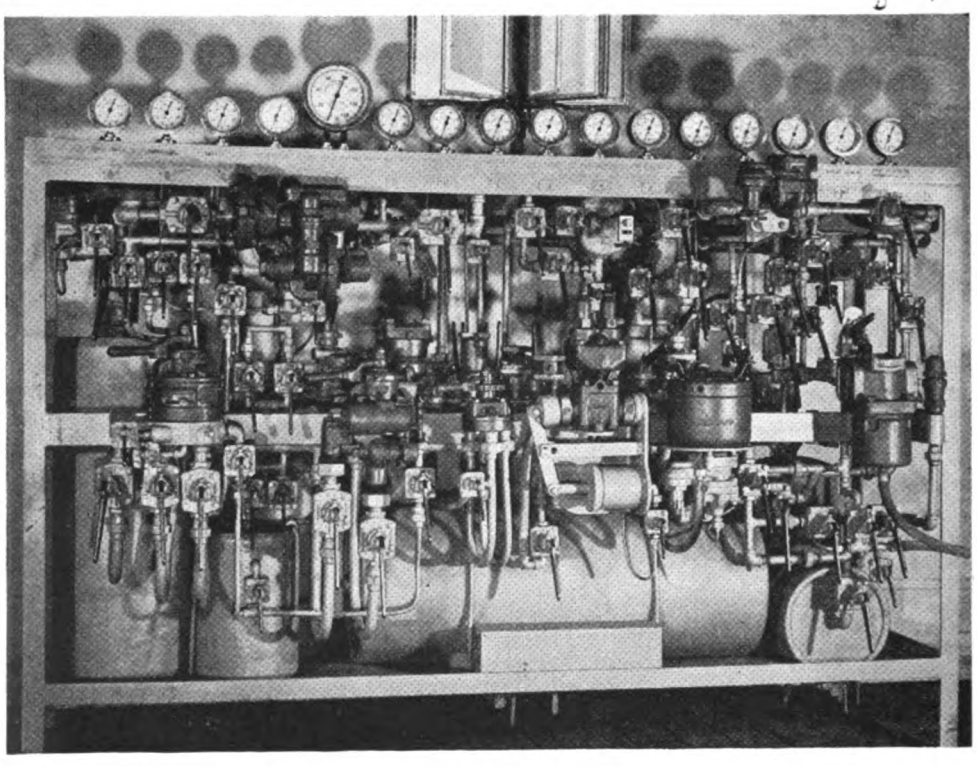
As indicated, this consists of two 3-in. by 4-in. side angles, spaced about 54 in. apart, provided with hooks at the upper ends to go over the bulb angle and united at the bottoms with a double angle base which serves to support the journal jack used in applying pressure through a suitable 4-in. square timber to the bent part of the bulb angle. A 3-in. cross channel stiffener is welded between the two side angles, as illustrated, and half-way between that and the top are two cross straps designed to hold the sliding U-bolt which positions the timber at any point between the sides of the device.

The hooks at the top are formed by bending the side angles and applying steel reinforcing plates by welding, as illustrated. A hook and chain attachment at the bottom holds the device against springing out when pressure is applied to the jack. Once this device is set up and properly positioned with respect to the bend in the top bulb angle, application of the necessary pressure by means of the jack will straighten the bulb angle.



Device for straightening top bulb angles on gondolas and hopper cars

* * *



A compact and all-inclusive locomotive air-brake test rack at the Frisco shops, Springfield, Mo.

Elimination of

Cinder Cutting a Big Problem*



E. H. Heidel,
Chairman

CINDER cutting of tubes and flues, continues to be a serious problem on coal-burning railroads, particularly at a time like the present when maximum output is demanded of all locomotives. The committee is unable to report that cinder cutting is completely understood or under control, but feels confident that definite progress is being made toward the eventual reduction or elimination of cinder cutting.

In accordance with established custom, the present committee prepared a questionnaire on cinder cutting designed to bring out certain information with regard to this subject. Replies were received from approximately fifty railroads in all parts of this country and Canada. It is evident that cinder cutting is a problem of considerable importance to practically all coal-burning railroads and has lately become a matter of serious concern due to accidents caused by collapsed flues traceable to excessive cinder cutting.

While the committee does not wish to draw any final conclusions from the replies received, it appears that the master mechanic front end is favored over other types of smokebox arrangements from a cinder cutting standpoint. The same can be said of the Type A superheater. In this connection, however, the committee has tried to bear in mind that large, modern locomotives in heavy, fast service owe a considerable part of their success to the Type E superheater, open-type front ends, syphons, circulators, improved grates, and other devices which make higher coal burning rates possible. A significant number of railroads reported excessive cinder cutting where 3½-in. superheater flues are used. Apparently the trend at present is toward superheater flues of larger diameter. Excessive cinder cutting will certainly not cause the return of smaller power, but will accelerate the study of combustion in the locomotive boiler to the end that improved performance together with a reduction in cinder cutting will result.

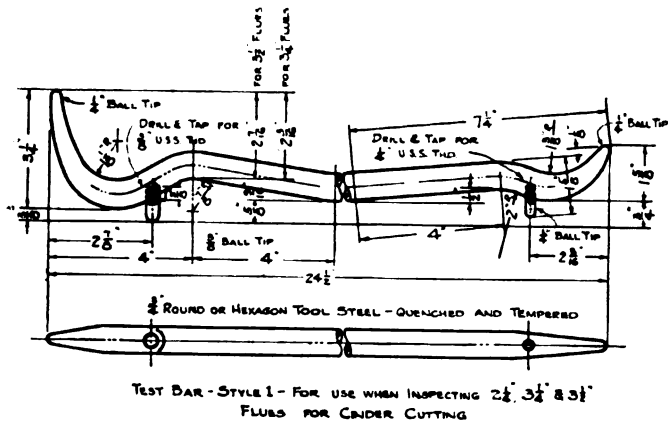
The question of baffle brick has been covered very well in preceding reports to the association. A number of railroads report unsatisfactory results with the baffle brick arch, but one railroad reports as follows: "The baffle brick arch is not a cure all, owing to the fact that it is placed in the firebox as a fixture. The passage of gases and cinders will change their travel, and if these baffles are left in the same place for any length of time, the main accomplishment is a change in location of the cinder cutting. These baffles should have a change of position every so often in order that the cutting or abrasive action would be universal over the entire flue sheet and flues, and not in one fixed place. The baffle brick arch has improved the condition of honey-combing and plugging of flues, and we would not remove them for any price on that account." Unfortunately, cinder breakers or baffles located to protect areas subjected to abnormal cinder cutting, add to gas restrictions and require a higher front end vacuum to support combustion in the higher ranges of firing.

Cinder cutting of tubes and flues is most pronounced at the back end of the tubes, principally adjacent to the prosser recess. This has led to the use by a number of railroads of safe ends of a heavier gage than that of the remainder of the tube. The use of a No. 10 gage safe end on all open flues on mountain type locomotives of one railroad has resulted in the life of the flues being considerably prolonged, and an epidemic of cinder-cut flues at enginehouses between shopping was stopped. This same railroad now proposes a safe end of No. 8 gage thickness for all open flues. While a number of railroads report favorable results with heavy gage safe ends their use is apparently not very widespread, and some roads report an increase in fire cracking of the flue bead when heavy gage safe ends are used. In connection with the question of safe ends, it is thought by some that the prosser mark on the flue has a bad effect due to possible eddy currents set up in the flow of gases, and this matter is being closely watched, as is also the weld between the safe end and flue.

The application of circulators to a firebox is thought by many boiler foremen to reduce cinder cutting. While there has never, apparently, been a specific test conducted to substantiate the reduction in cinder cutting in circulator equipped locomotives, there is evidence that a reduction in cinder cutting exists in locomotives so equipped, in which case the useful life of sheets, tubes and flues is extended. A combination of features embodied in circulators and the circulator arch can theoretically be used to account for good results in the reduction of cinder cutting. The "dutch oven" effect over

* Report on Topic No. 5 prepared for the 1943 year book of the Master Boiler Makers' Association.

the fuel bed as provided by the circulator arch provides an excellent radiating effect upon the fuel bed, and this arch together with the positive mixing action of the circulator cross arms plays an important part in the mixing, retarding and deflecting of cinder cutting combustible particles which otherwise would be drawn unhampered over the ordinary arch directly to the tubes and flues. Another theoretical advantage of circulators in the reduction of cinder cutting is the effect the circulator risers have upon such unconsumed particles as may be drawn from the stoker pot and over the end of the arch. These risers, spaced intermittently above the arch, reduce the cross sectional gas area at each unit and create a pulsating effect sufficient to discourage a concentrated impingement of cinders upon any particular location of sheet, tube, or flue. A reduction of honeycombing and flue plugging is claimed for circulator



Test Bar - Style 1 - For use when Inspecting 2½", 3½" & 5½" Flues for Cinder Cutting

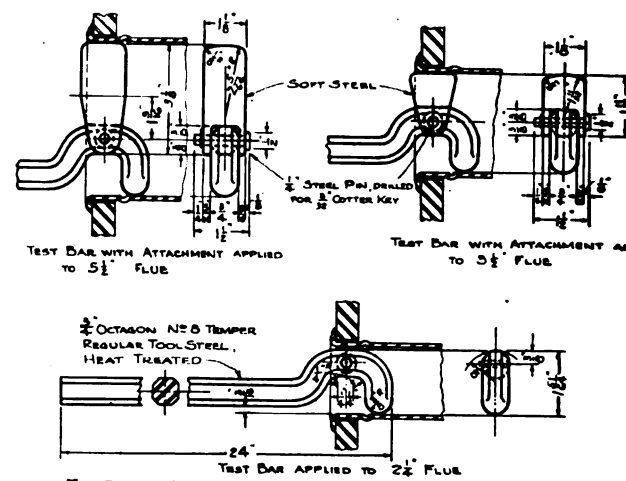
Fig. 1—Test bar for use when inspecting flues for cinder cutting

equipped engines which is a further step in the reduction of cinder wear as clogged flues throw an increased gas velocity through open tubes and flues, and invite concentrated cinder cutting.

Apparently, all coal-burning railroads have cinder cutting to some degree, and this condition is more pronounced in territories burning coals having combustion by-products of highly abrasive characteristics. In such territories, the higher the working rates of the locomotives, the more cinder cutting takes place because of increased gas speeds. One western road reports a decrease in cinder cutting after a reduction in grate air opening, probably due to reduced fuel bed turbulence when the locomotive was working at maximum output. Generally speaking the slowest possible gas speeds attainable which will not only maintain combustion rates, but prevent smoke trailing should be our goal and can be achieved by eliminating all unnecessary restrictions in the exhaust steam passages and in the path of the gases from the fuel bed to the stack. This will result in higher smokebox vacuum per pound of operating back pressure, causing less damage from cinder abrasion for the reason that combustion rates can be maintained at slower gas speeds.

The committee's attention has been directed to two new developments in locomotive drafting designed to effect adequate combustion rates at slower gas speeds. The first of these devices, now being used with uniformly good results on a number of roads in widely separated parts of the country, cannot be described or commented on at length by the committee at this time. Locomotives equipped with these devices are operating successfully with a very appreciably larger nozzle than locomotives of the same class not so equipped in the same service. This is mentioned by the committee in support of the statement made at the beginning of the report that progress is being made toward reduction or elimination of cinder cutting.

The other development is a system of controlled back pressures and draft conditions now in use on a number of Grand Trunk and Canadian National locomotives. The committee on cinder cutting is very much indebted to W. H. Clegg and R. R. McIntosh of the Grand Trunk Western for permission to mention the front end developed under their direction which is doing an outstanding job on a number of locomotives at the present time. This arrangement provides ample draft for both minimum and maximum firing rates by means of a conventional nozzle of rather small cross sectional area but without excessive back pressure, the maximum back pressure being controlled by means of unloading valves located in the exhaust stand exhausting to the atmosphere. This system also limits the front end draft to any predetermined amount based on the resistance through the ash pan, grates, firebed and flues. Due to the consistently clean condition of the fire maintained by the minimum draft carried always exceeding the amount required to overcome resistance to air flow, the total rise in firebed resistance is kept low and the carry-over of large cinders and unburned fuel is reduced to a minimum on account of the resulting low velocity of air flow through the firebed. By means of an air duct leading directly from the atmosphere to the smoke box, the smoke box vacuum is automatically broken whenever the draft exceeds the predetermined amount. The duct at other times is sealed off by a valve disc with seat. This system is entirely independent of any manual operation by the engine crew, and moving parts are kept at a minimum. Through reduction in back pressure a very appreciable improvement in fuel economy is effected,



Test Bar, Style 2, and Attachments for Determining Cinder Cutting

Fig. 2—Various attachments make this test bar useful on several sizes of flues

and cinder cutting is practically eliminated. This front end arrangement is held in high regard by enginemen, and it is significant that these locomotives are operated in Michigan and in Canada with no front end netting whatever.

The committee has attempted to determine variations in the abrasiveness of various front end cinders, but without much success. The analysis of Franklin County, Ill., coal, stack cinders, and ash is shown in the table. Due to lack of knowledge as to the condition of the cinders at the time they are passing through the flues,



Cinders removed from locomotive front ends in various parts of the country differ considerable in size and abrasive qualities

it is difficult to compare the abrasiveness of the cinders taken from various front ends. A photograph showing cinders removed from locomotive front ends in widely separated parts of the country is shown, the weight of cinders in each pile being the same. The cinders in the pile on the right-hand side were removed from the Grand Trunk locomotive mentioned above.

The number of cases of collapsed flues experienced recently makes it very desirable to subject all flues sus-

Analysis of Franklin County, Ill. Coal

Coal Analysis

Kind of coal	Fixed carbon	Volatile	Moisture	Ash	Sulphur	B. t. u.
Mine run	47.85	34.51	8.01	9.89	0.95	11,935
Nut	48.16	34.30	8.93	8.61	0.88	11,944
Egg	48.91	34.39	8.77	7.93	0.90	12,089
Lump	47.67	34.47	9.01	8.85	0.82	11,874

Analysis of Stack Cinders

Kind of coal	Fixed carbon	Volatile	Moisture	Ash
Mine run	73.51	3.45	0.29	22.75
Nut	73.37	2.27	0.09	24.26
Egg	74.53	2.67	0.11	22.69
Lump	72.44	2.80	0.22	24.55

Analysis of Ash

Kind of coal	Fixed carbon	Volatile	Moisture	Ash
Mine run	25.88	2.93	0.63	70.55
Nut	21.88	1.59	0.65	73.37
Egg	27.40	1.86	0.18	74.53
Lump	28.39	1.89	2.19	72.44

Typical Limits of the Constituents of Ash

Silica, per cent	40 to 60
Alumina, per cent	20 to 35
Ferric oxide	1 to 20
Magnesia, per cent	0.5 to 4
Lime, per cent	1.0 to 15

pected of excessive cinder cutting to a periodic examination with a test bar. Typical test bars are shown in Figs. 1 and 2. The committee respectfully directs attention to the recommendation of the Bureau of Locomotive Inspection as follows: "It is recommended that the railroad take immediate steps to have all flues that are subject to excessive cinder cutting tested by means of the test bar at regular and frequent intervals; that such flues be removed without delay whenever any indication of undue thinning becomes apparent, that all flues be bored or blown out sufficiently often to prevent accumulations of cinders with consequent impairment or stoppage of draft there through, and that such other means as may be found practical to equalize, so far as possible, the velocity of the products of combustion through the flues be applied to all boilers."

The committee feels that definite progress is being made toward reducing or eliminating cinder cutting of tubes and flues, but that the subject warrants a great deal of further study. It is hoped that the foregoing report will lead to a general discussion of cinder cutting.

The report was signed by E. H. Heidel (chairman), general boiler foreman, C. M. St. P. & P.; C. A. Harper (vice-chairman), general boiler inspector, C. C. C. & St. L.; A. T. Hunter, assistant general boiler inspector, A. T. & S. F.; S. A. Fegan, district boiler inspector, Can. Nat., and A. D. O'Neil, chief boiler inspector, Pere Marquette.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Cutting Tubing With a Blowpipe

Q.—I often notice superheater flue ends and pieces of pipe that have been cut with the oxyacetylene blowpipe on which the ends are free from slag accumulation. However, when I cut pipe or flues there is so much slag in the pipe or flue that I have to grind it away to prepare for welding. Am I doing something wrong that can be corrected?

A.—The accumulation of slag on the inside of the pipe or flue is caused from the position of the blowpipe when cutting. In other words, you are cutting pipe in the same manner you would cut plate or bar stock. To get a good clean cut free from slag, hold the blowpipe so that the slag will be blown out of the cut and not through it. As the cut reaches the bottom move the blowpipe along and repeat this operation all the way around the pipe or flue. Using the blowpipe in this manner it is much easier to keep the cut straight and clean with a resulting surface free from slag which has a slight angle just right for welding.

Plugging Holes in Cast-Iron Cylinders

Q.—Several times in recent months we have applied second-hand half cylinder saddles. Usually the frame bolt holes in the second-hand half are so large that to ream the frame holes to that size would nearly ruin the frame. We have attempted to drive steel plugs into these oversize holes and then braze them in but each time the bronze cracks and the plugs turn when the holes are reamed. Can these plugs be applied so that they will stay in place?

A.—To braze steel plugs in frame bolt holes in a cast-iron cylinder requires a little preparation. If the holes are rusty or cut out of round ream them so that the plug will be a tight fit. Chip a 45-deg. angle ½ in.



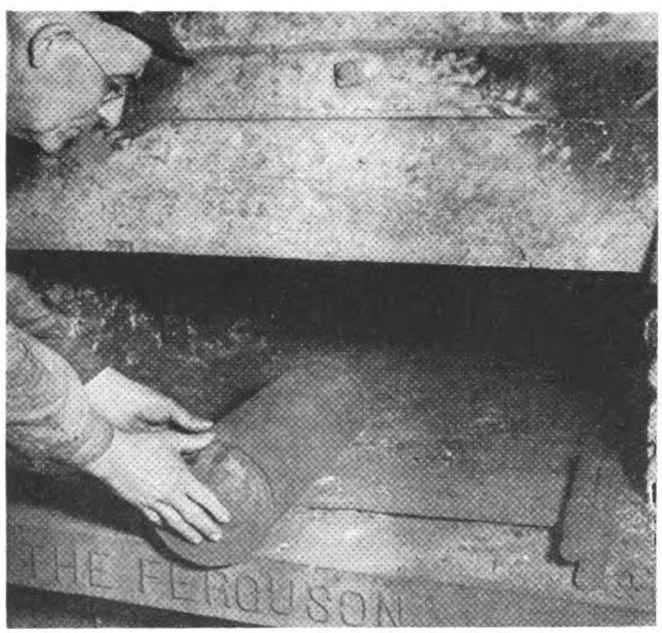
Oversize holes in cast-iron cylinders can be filled with steel plugs brazed in place

deep around the ends of the bolt holes. Drive the plugs solidly leaving them ½ in. short on one end. Braze about one fourth of the plug to the cylinder and while hot peen vigorously. Repeat the operation peening each quarter until the cavity is filled just flush. When the piece has cooled, chip and grind it. Plugs applied in this manner will not loosen when reaming.

Welded Cylinders For Annealing Tools

Q.—Can the contour tools used to form the flange of driving wheels be annealed so that they can be remachined?

A.—Driving-wheel lathe flange-forming tools offer quite a problem in annealing. However, with proper preparation they can be annealed. First weld a head of ¼-in. plate on some sort of a cylinder, a piece of 6-in. or 8-in. pipe serves nicely. Pack the wornout tools



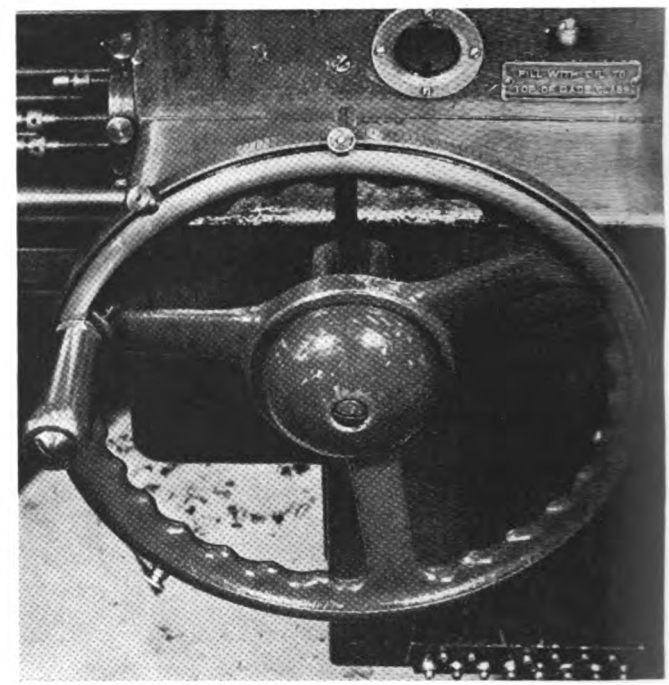
Welded cylinder in which tools packed in charcoal are placed in an annealing furnace

into the cylinder with fine charcoal taking every precaution to keep the tools separated from one another with charcoal. When the cylinder is packed full, arc weld a head on the open end. Place the cylinder in a furnace and heat at 1,500 deg. for eight hours. Cooling takes considerably longer as the tools must be left in the furnace until they reach room temperature. When the cylinder is cool one head is removed with the cutting blowpipe. The tools may now be laid out and machined to the desired shape.

Calibrated Handwheel For Lathe Cross-Slides

A calibrated handwheel for turret lathe cross-slide longitudinal travel, used with or without the regular machine stops, has been devised at the Pittsfield works of the General Electric Company to obtain closer and more uniform dimensions than can be obtained with stops alone. An additional advantage is that inexperienced operators can do the work required when using the handwheel.

The wheel periphery is graduated to represent 0.005 in. travel for each mark and has adjustable pointer clips



Calibration of the handwheel aids in working to close dimensions by inexperienced operators

which slide in a "T" slot in the outer edge of the wheel. The outside diameter is turned flat before being graduated and when the handle is removed from the wheel the slot is machined for the pointer clip bolts to slide in easily.

An opening through which the "T" head bolts may enter the groove is provided at the point where the handle bolts to the wheel. When the handle is in place, the bolts are prevented from leaving the slot. Thumb nuts for the "T" bolts, which can be easily adjusted, hold the pointer clips in place. A reference pointer is formed by a bracket which extends from the wheel hub housing.

When the handwheel is used with a stop, the stop is permitted to kick off the feed before the full travel and the cut is completed by turning the proper pointed clips up to the reference pointer. Uniform dimensions to within 0.001 in.-0.0015 in. are obtained by the use of this method.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Are Staybolts Considered As Heating Surfaces?

Q.—In order to obtain accurate results in calculating locomotive boiler heating surface should the area of the staybolt heads be deducted?—W. H. P.

A.—The following rule is commonly used for computing the heating surface of a locomotive type boiler:

1.—Tubes and flues. Use wetted (outside) surface, between the tube sheets.

2.—Arch Tubes. Use wetted (inside) surface, length measured on the center line between sheets.

3.—Firebox. Use wetted (outside) surface from top of the firebox ring. Deduct the firedoor hole and tube and flue holes.

It will be noticed that in item 3, no mention is made of deducting the area of the staybolts. I do not believe it would be correct to deduct this area, for, while the staybolts would not conduct the heat as rapidly as the firebox sheet itself, they cannot be considered as non-conductive and, therefore, some of the heat of the staybolt is carried to the water surrounding the staybolt and can be considered heating surface.

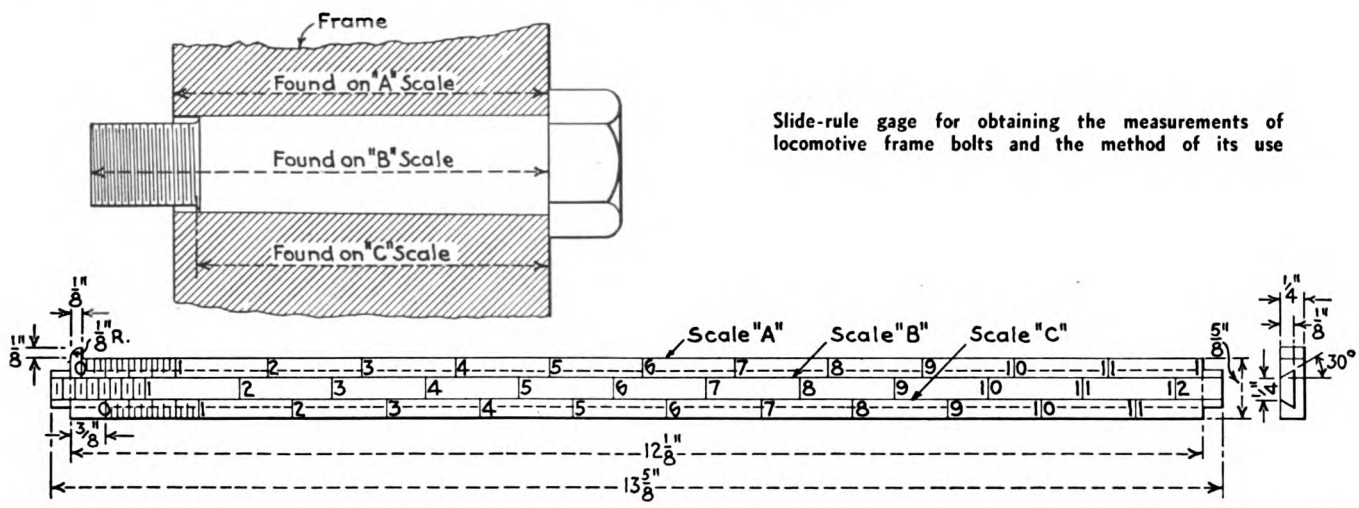
Welding Patches on Barrels of Locomotive Boilers

Q.—On page 200 of the May, 1941, *Railway Mechanical Engineer*, under the heading of "Seal Welding of Boiler Shell Patches," appears this sentence, "The Bureau of Locomotive Inspection proposed rules for welding provides that welding shall not be applied to any part of the barrel, etc." This, of course, was a proposed rule. Is or was there a rule or ruling relating to the welding applied to the barrel of a locomotive boiler? Say, to seal the caulking edge of a patch? If there is, can you quote it.—E. L. V.

A.—The Bureau of Locomotive Inspection does not have any ruling which would permit welding to seal the caulking edge of a patch applied to the barrel of a locomotive boiler. The proposed rules and instructions governing the use of fusion welding on locomotives, boilers, tenders and parts and appurtenances, thereof, as issued by the Bureau of Locomotive Inspection, I. C. C., state as follows: Rule 4 "Barrel, dome, drum and hip sheets. Welding shall not be applied to any part of the barrel, dome, drum, or hip sheet of any boiler unless the stresses to which the part is subjected are carried by other construction that will maintain the required factor of safety. This will not prohibit welding of joints of shell sheets at ends of butt straps to seal leakage or prohibit the welding of staybolt sleeves or caps in that portion of the barrel into which the combustion chamber extends." The fact that the stresses on the barrel of locomotive boiler are not carried by any other construction would prohibit welding on the same. I do not believe that the exception, which permits welding of joints of shell sheets at ends of butt straps to seal leakage, could be construed so as to apply also to seal welding the caulking edge of a patch.

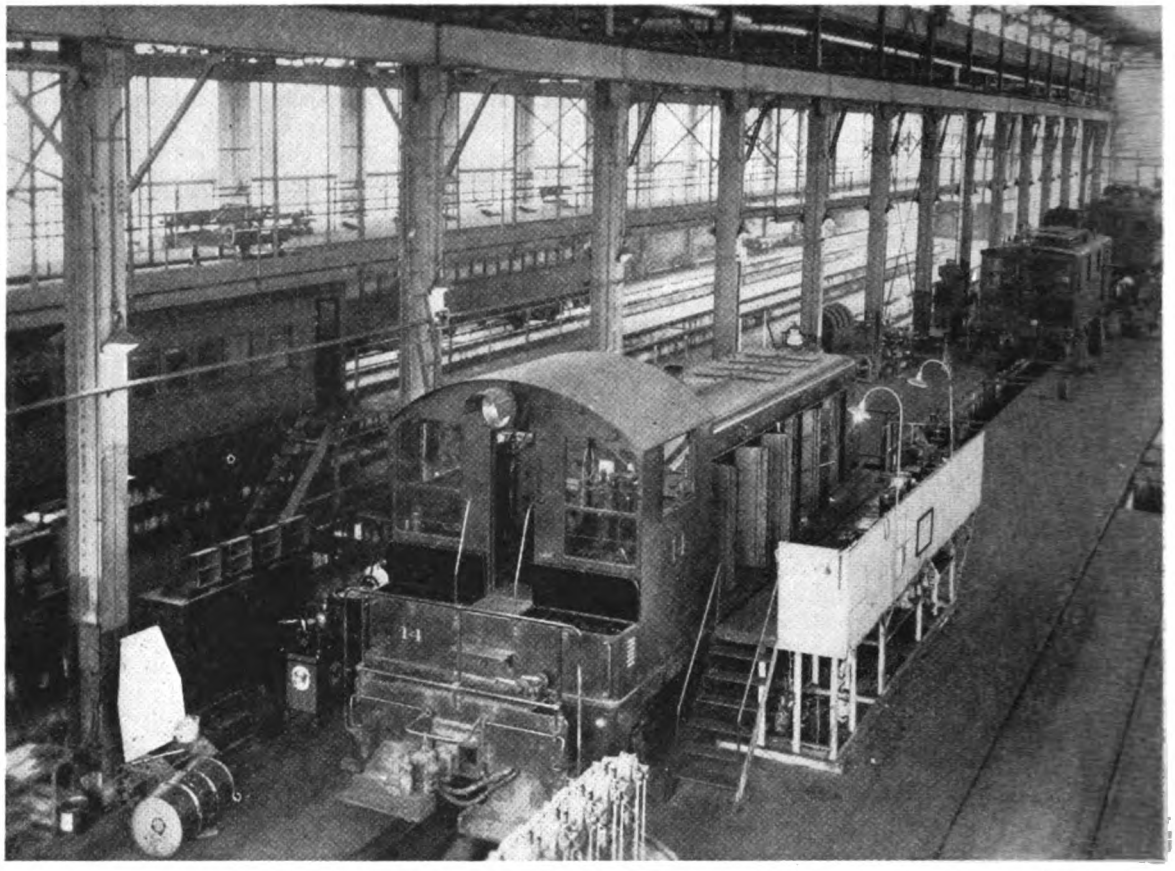
Slide Rule Gage For Selecting Frame Bolts

The accompanying drawing shows the details of a slide rule type of gage for use in obtaining the measurements for selecting and making locomotive frame bolts. The gage itself consists of two parts—the body on which scales *A* and *C* are graduated, and the slide operating in a dovetail slot on which scale *B* appears. All three scales are graduated in eighths and sixteenths of an inch. The body of the scale has a hooked end at the side on which scale *A* appears, the purpose of which is obvious. Scale *A* is used as a hook scale to obtain the measurement through the frame, as shown in the lower portion of the drawing. Scale *C*, it will be noticed, is graduated so that the zero and all inch divisions on the scale are a one-fourth inch differential from scale *A*. Scale *C* is used to obtain the dimension of the unthreaded portion of the bolt body and the one-fourth inch differential allows for the draw. In using the gage, scale *B* is set to the thickness of the nut wanted on the frame bolt by setting the dimension representing thickness opposite the zero on the *A* scale. The measurement through the frame can be taken as a direct reading on the *A* scale, and directly opposite that point the other dimensions may be obtained. These are the full length of the bolt under the head from the *B* scale, and the length of the unthreaded portion of the bolt body, from the *C* scale.



Slide-rule gage for obtaining the measurements of locomotive frame bolts and the method of its use

Electric Shop Takes Diesel Boarders



Looking north across the heavy-repair tracks in the center bay—Elevated tracks in the inspection bay may be seen at the left

Reading finds practically all shop equipment used for m. u. electric cars needed for Diesel locomotives—additional facilities required for engines

BENEFITING by years of experience in maintaining m. u. electric cars, Diesel-electric locomotive maintenance was also organized in Reading's multiple-unit shop at Wayne Junction, Pa., when this type of motive power was adopted for switching and transfer service in the Philadelphia area.

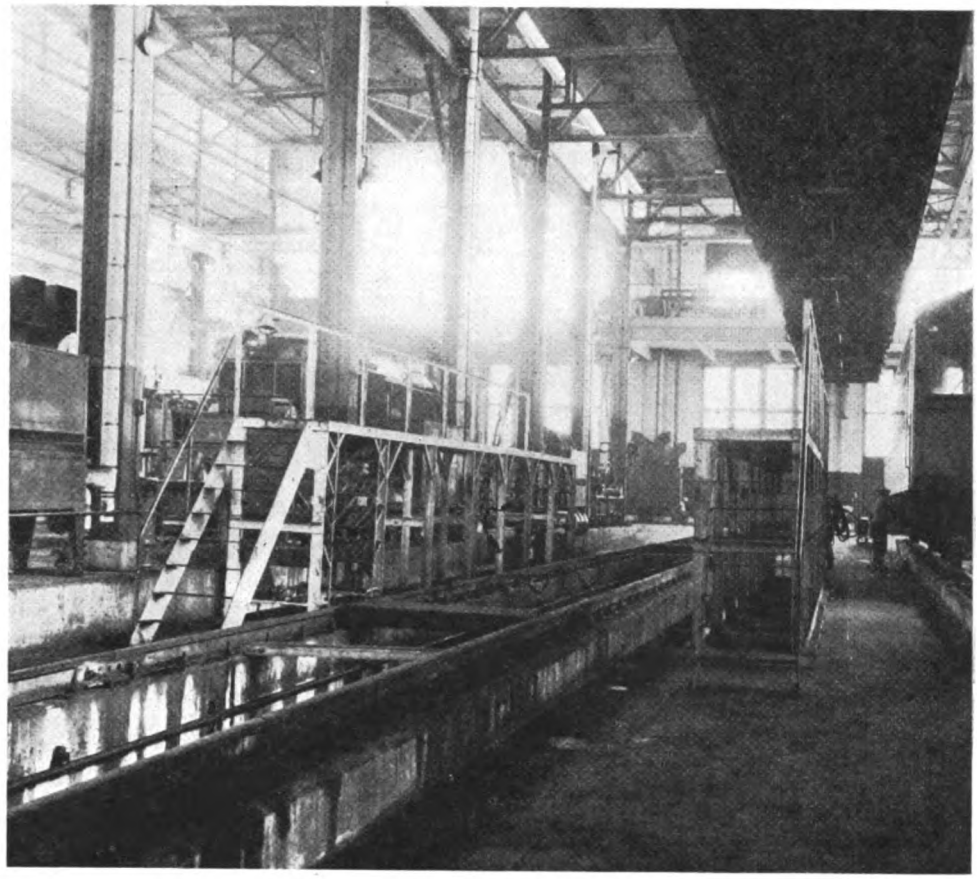
This arrangement has placed in the hands of the Diesel maintainers all the facilities which experience showed were required by electric cars. It has also served to segregate Diesel and steam locomotive repairs, thus meeting the requirement of cleanliness which is so important both for electrical equipment and Diesel engines.

Practically all of the shop facilities used for m. u. electric-car maintenance have been found advantageous for Diesel-electric locomotives. Additional facilities were needed for the Diesels and some of these have served to benefit the work done on the m. u. cars.

All of the major facilities at the Wayne Junction shops are listed in the table. The items which have been added since the advent of the Diesel-electric locomotives are shown in italics.

The shop was originally designed for the maintenance of 120 m. u. cars. By dint of management and experience, it has become possible to include also the maintenance of 48 Diesel-electric locomotives in the same shop. Special requirements for the Diesels are floor space for overhauling of engines and facilities separated from the shop for cleaning filters and engine parts. This requires plenty of hot water and steam.

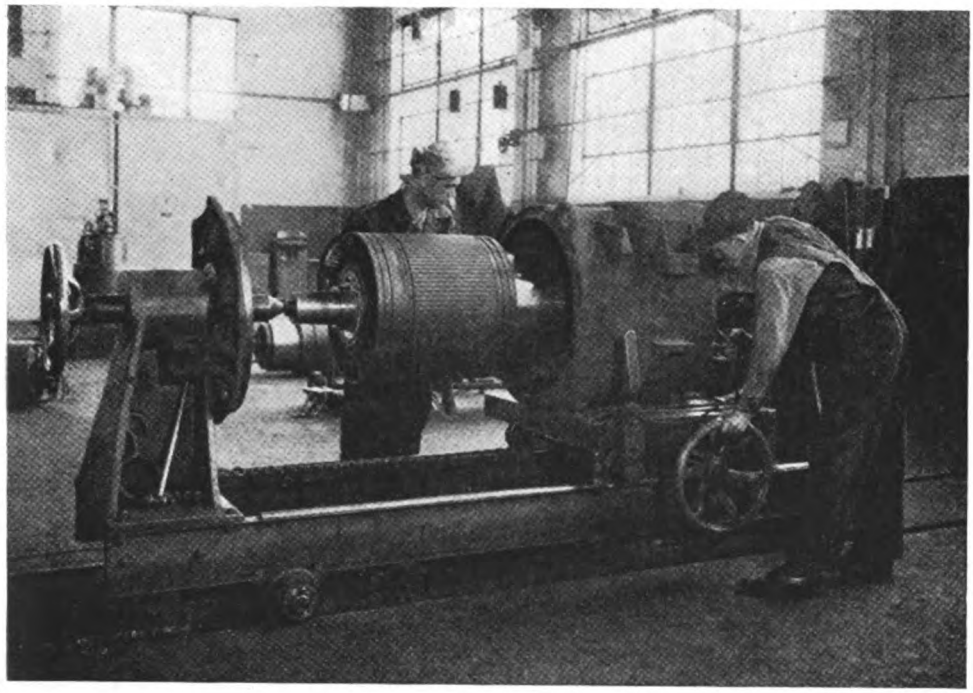
In a number of cases, new facilities absolutely necessary for Diesel maintenance can also be advantageously applied to m. u. car maintenance. This is one reason why



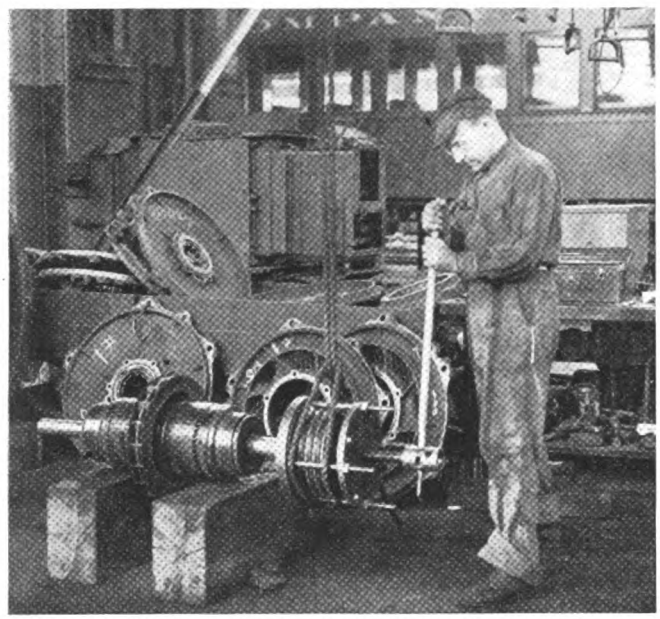
Looking south in the inspection-track bay—The center bay with its heavy-repair tracks is at the left



General view of the machine-shop bay looking north—Heavy-repair tracks on the left



The armature extractor



One of the more common types of pullers removing a V pulley from a Diesel exciter and control generator

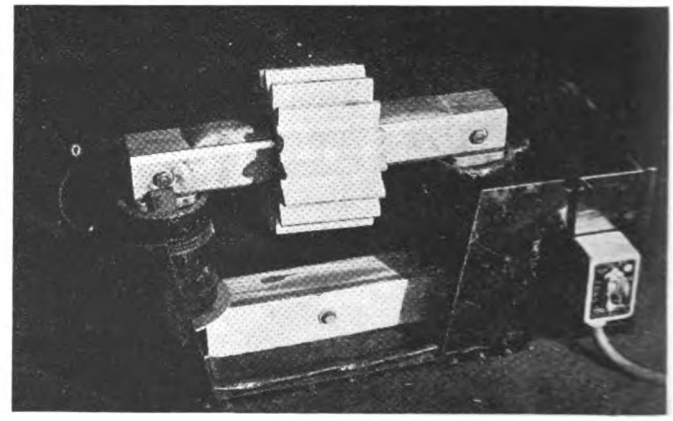
Shop Equipment Used for M. U. Electric Car and Diesel-Electric Locomotive Maintenance at the Reading's Wayne Junction Repair Shop*

1—Repair and inspection shop, 138 ft. 4 in. by 325 ft. 0 in.
2—Five through tracks, including two heavy-repair tracks with 210 ft. inspection pits and three tracks with full-length inspection pits.
3—Four 35-ton Whiting electric (synchronized control) car hoists.
4—Machine shop, 30 ft. by 122 ft.
5—Storeroom, 30 ft. by 61 ft.
6—25-ton Niles crane traveling over two heavy-repair tracks, span 42 ft. 1 in., main hoist 25 tons capacity—auxiliary hoist 5 tons capacity.
7—One 7½-ton Niles traveling crane over machine-shop bay, span 30 ft. 0 in. operated from floor.
8—30-ton capacity lifting beam.
9—G.E. portable arc welder, motor 440 volts a.c., generator 25 volts and 300 amp. d.c.
10—Motor-driven Putnam 42-in. wheel lathe.
11—Electric baking oven manufactured by Despatch Oven Co., 9 ft. by 9 ft. by 8 ft. deep, two tracks and two six-wheel trucks.
12—Three dipping and cleaning tanks, 4 ft. by 4 ft. by 10 ft.
13—Filter press, 4 to 7 gals. per min., Westinghouse motor-driven.
14—20-in. Rockforn shaper.
15—Peerless 4½-in. by 4½-in. dry-cutting power saw.
16—Barnes two-spindle 20-in. drill press.
17—Two Model K-3 high-speed sensitive drills.
18—Dreses 5-ft. radial drill.
19—14-in. by 8-ft. engine lathe.
20—24-in. by 10-ft. engine lathe.
21—Blount 30-in. wet tool grinder.
22—Hammond double emery grinder.
23—Peerless universal armature machine.
24—Armature extractor for traction motors.
25—Two armature winding stands.
26—Two m.g. sets for battery charging, one for m.u. cars and one for Diesels.
27—Motor-driven compressor, 12 in. by 10 in., class BR 1, with after-cooler and storage tank.
28—Portable rivet-heating furnace.

it has been possible to include the Diesels without making the shop inadequate for both. With a few exceptions, the electrical repair equipment in the m. u. shop is more than adequate for serving electrical requirements of the Diesel locomotives.

No changes were required in the layout of the shop except the extension of one of the original inspection pits on one of the two heavy repair tracks. This pit was extended and provided with reinforced jacking foundations outside the track gauge. Hoists (item 3 in the table) were added since the crane capacity was not sufficient for the Diesels. All locomotives have four-wheel trucks.

The original storeroom was inadequate for both m. u. cars and Diesels. Line materials for the overhead contact system of electrification were formerly kept in the



A pinion heater

29—Portable welding and cutting outfit.
30—Two test racks for air-brake equipment, one for m.u. cars and one for Diesels.
31—Small baking oven.
32—*Valve facing equipment (portable).*
33—*Wire brush machine (portable).*
34—*Cylinder-head reconditioning tools.*
35—*Cylinder liner hone.*
36—*Commutator dressing tool for in-place reconditioning with shop-made jigs for main generator, auxiliary generators and traction motors.*
37—Shear for cutting light metal and insulation material.
38—Induction-type heater for motor pinions.
39—Various types of pullers for removing pulleys, gears and couplings.
40—*Hand pyrometer for taking exhaust temperatures.*
41—*Diesel-engine-oil flushing equipment.*
42—*Wrenches, socket, open-end, box, ratchet.*
43—*Injector, nozzle and fuel-injection pump testing devices.*
44—*Air-intake-strainer cleaning tanks.*
45—Diesel-engine-parts cleaning tanks.
46—All necessary equipment for testing meters, relays, regulators, etc.
47—Gauge tester (oil and air).
48—Gas-electric crane truck, 1½ ton.
49—Four elevated work platforms (running-board height equipped with lighting, vise bench and storage shelves—one has tool rack.
50—Shop heated with unit steam heaters.
51—*Motor-driven ventilator for removing exhaust gas fumes from shop.*
52—*Floor benches (air-brake work done on balcony).*
53—Wheel storage outside shop.
54—*Bench trays for cleaning small Diesel parts.*
55—One-ton service (highway) truck for work in field.
56—*Portable all-purpose motor-driven pump.*
57—Magnaflux testing machine.
58—Fully equipped blacksmith shop, oil-fired forge, air hammer, small hand tools, etc.

* Items of equipment added since the advent of Diesel-electric locomotive maintenance are printed in italics.

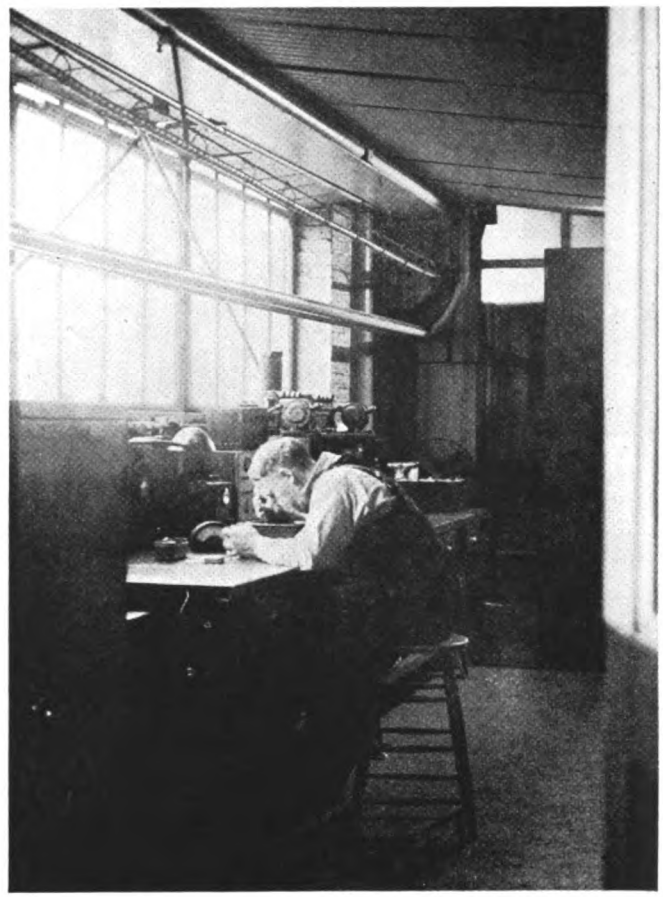
storeroom and these were moved to another building. Some material was moved to a room in the basement and shelf space was increased about 50 per cent.

The 42-in. wheel lathe (item 10 in the table) was adequate for m. u. cars but it cannot be used on some locomotives which have larger journal sizes. The increased mileage now being made by m. u. cars has also put an added load on this lathe and it will be replaced by one of greater capacity. The small lathes (items 19 and 20) are used for bearings, bushings and general work.

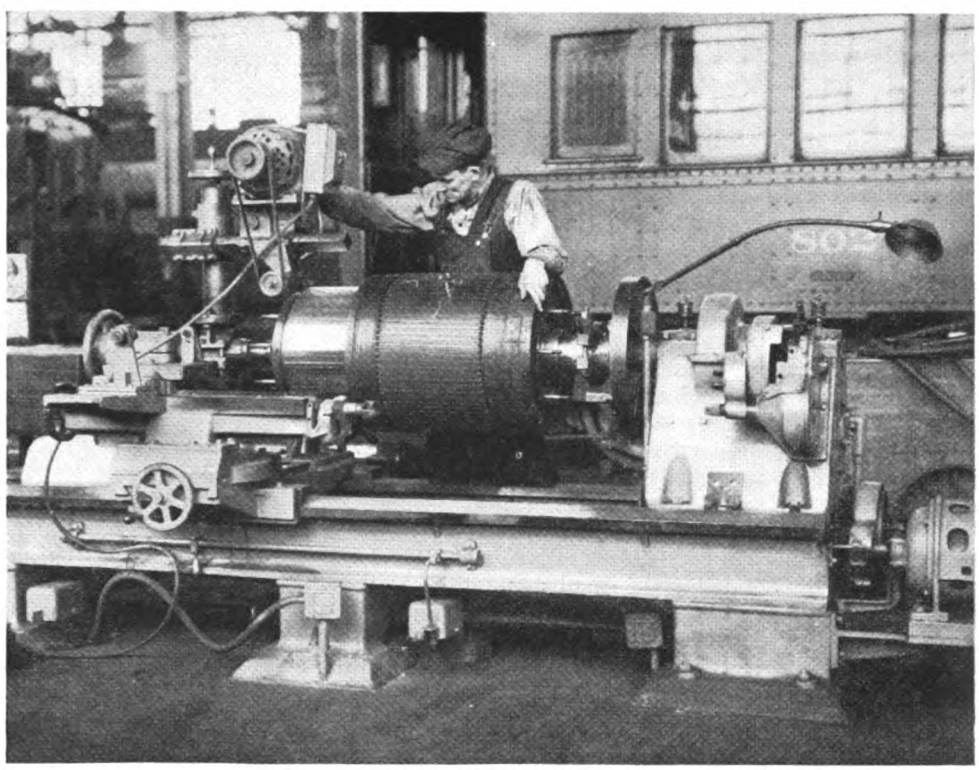
The armature extractor (item 24) was made for m. u. traction motors and will also handle certain types of Diesel traction motors. It is not large enough for generators and will be supplemented by another extractor of sufficient size.

The shop was originally equipped with one motor-generator set for charging of m. u. control batteries. The second machine was made necessary because the locomotives employ larger batteries having voltage ratings up to 125, while the m. u. cars use 32-volt batteries.

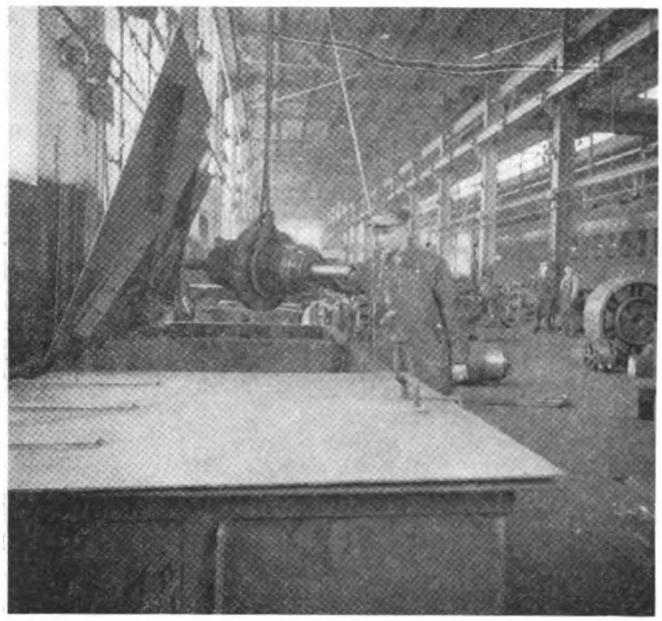
The motor-driven compressor (item 27) is used to



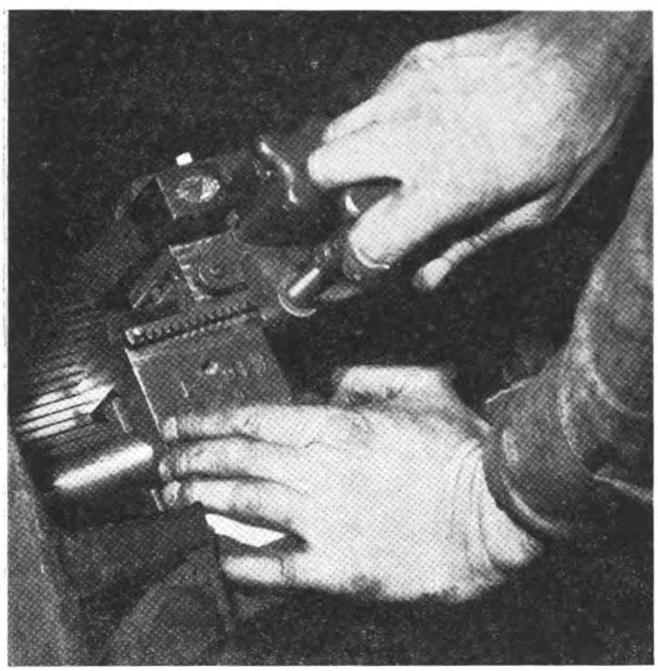
The meter repair room



One of the lathes as used for commutator slotting



The dipping tanks for cleaning fluids and insulating varnish



Grinder attached to brush studs used for truing generator commutators

supply air for the operation of shop tools and other facilities.

The portable valve-facing equipment (item 32) is used for facing all intake and exhaust valves and is exclusively a Diesel facility.

The Diesel-engine-parts cleaning tanks were installed as a Diesel locomotive facility but have been found highly useful for m. u. cars. Electric immersion heaters are used for heating the cleaning solution.

Equipment for testing meters, relays, regulators, etc. (item 46) is all included in the small shop on the balcony. In this shop one man repairs cab signal relays for all Reading cars and locomotives, relays for m. u. cars and Diesel locomotives, all electric meters used on the railroad, rejuvenates Pliotron tubes, etc.

The gas-electric crane truck was installed for work on Diesel locomotives and also does some other shop work. About 90 per cent of its time is used in connection with locomotive repairs.

The elevated work platforms (item 49) are located on the section of tracks assigned for Diesel monthly inspection, annual inspection, and in running repair work. These platforms are exactly the same height as the deck of a Diesel locomotive and of length equal to that of the longest piece of equipment in service. On one platform is located a work bench with the various facilities needed for overhauling fuel injectors, cylinder heads, and other light engine accessories. The floor between the inspection tracks is depressed so that the top of the rails are about 24 in. above the floor. There are also full-length pits between the rails. Tool storage bins have been installed in three of the platforms. When it is necessary to overhaul a Diesel engine completely, the engine is removed from the locomotive, torn down, repaired and reassembled on the shop floor.

When the Diesel locomotives were brought into the shop a motor-driven ventilator for removing exhaust gas fumes was placed in the roof. Experience indicates that this type of ventilator is inadequate and that a hood is required directly over any locomotive which may have to be operated in the shop. The roof ventilator will remove a major part of the exhaust gas but will not prevent dissipation of objectionable fumes throughout the shop.

The one-ton highway service truck (item 55) was installed for servicing all Diesel locomotives anywhere in the Philadelphia area. It has also been found highly useful for emergency requirements of m. u. cars.

The Magnaflux testing machine (awaiting delivery),



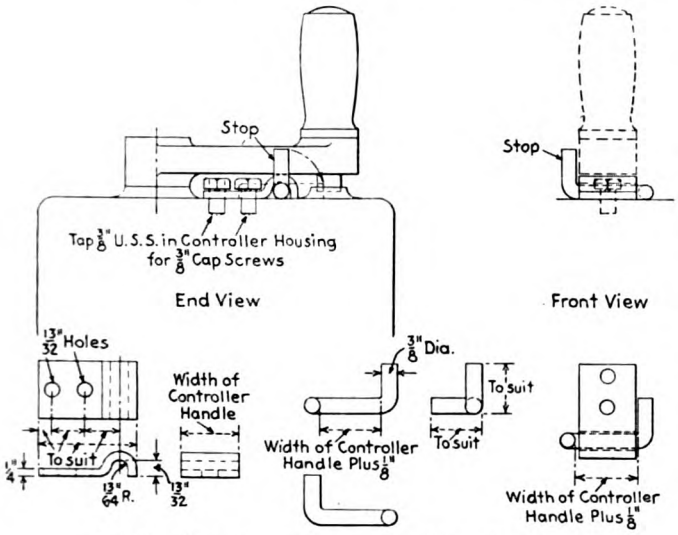
An m. u. transformer goes into the baking oven

installed primarily for Diesels, will also be useful for m. u. cars. It is especially effective for Diesel connecting rods, crank shafts, armature shafts and roller bearings.

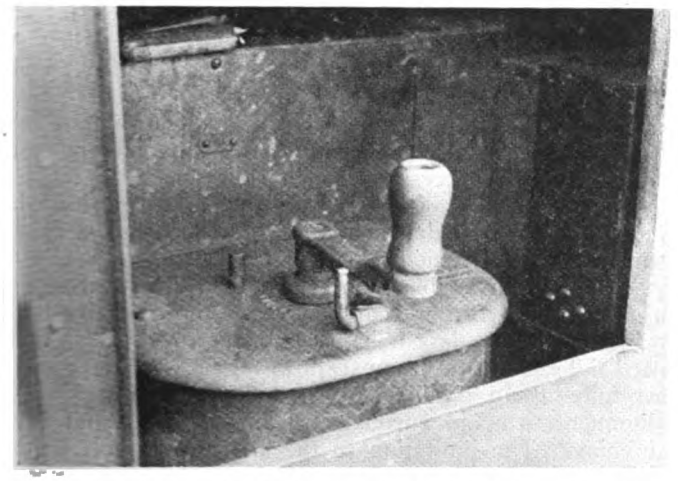
The Diesel locomotive repair facilities were planned and their installation directed by E. P. Gangewere, superintendent of motive power and rolling equipment.

Turntable Motor Saver

Ever since there have been electrically-operated turntables, the motors on this most vital piece of equipment have been subject to abuse. Operators are many and varied and most of them have little consideration for motors. This situation in most cases is aggravated by



Details of parts required for making the stop



Top of turntable controller showing the handle in neutral position against the stop

the fact that the type of controller most commonly used is one in which the handle can be moved from forward to reverse without delay, and the net result is that when the table goes by the right track, the operator throws the controller into reverse without using the brake. By this procedure he saves time and perhaps avoids criticism from the man on the engine. Unfortunately it is rough treatment both for the motor and the drive.

The simple but ingenious device shown in the illustrations was developed on the Chicago, Rock Island & Pacific to avoid this difficulty. When operating in either direction, the stop is always up at the neutral position. When the handle is moved from a running position to neutral, it runs into the stop and it is necessary for the operator to move the stop from one position to the other before he can put the motors in reverse. The little time required to do this saves the motors and improves table operation.

Substitute Solders and Babbitts

General Electric research and experiment has produced a number of solders and babbitt alloys containing little or no tin which are generally satisfactory and has also developed techniques for using them. Changes in the composition of solder and babbitt used by the company since Pearl Harbor have resulted in the saving of 850,000 lb. of tin. Present practices are as follows:

For general-purpose work a solder containing 20 per cent tin, 1.25 per cent silver, 1.5 per cent antimony, and the balance lead may be employed. It can be used with non-corrosive fluxes such as rosin or aniline phosphate, on bare, pretinned, or cadmium-plated surfaces; a corrosive flux, such as the zinc chloride types, is used for bare steel and zinc-plated copper or steel. Rupture strength at elevated temperatures is better than that of 40-50 per cent in tin-lead solder. This 20 per cent tin solder is the most popular solder in use today. It is being used in wire form, both solid and rosin-cored, for all types of electrical connections which formerly were made with solders ranging from 40 per cent tin, 60 per cent lead to 60 per cent tin, 40 per cent lead. About the only change in technique required to use the lower tin solder is to use a hotter soldering iron since the 40 per cent tin solder melts at 455 deg. F. and the 20 per cent tin solder at 518 deg. F. This new solder is also used in larger solder pots in place of 40 per cent tin solder for soldering armatures.

A silver solder, containing 2.5 per cent silver and the balance lead, and melting at 579 deg. F. is used chiefly for applications requiring high rupture strength at elevated temperature. This solder does not flow and wet as readily as pure tin. It calls for a corrosive flux on bare surfaces, but rosin flux can be used on pretinned surfaces. It is used chiefly for soldering rotor binding bands.

Two compositions are being used for pretinning or dip-soldering in solder pots, but neither is recommended for soldering-iron work. One consists of 10 per cent tin and 90 per cent lead, and melts at 567 deg. F.; the other has 10 per cent tin, 1.5 per cent silver, and 88.5 per cent lead. The second has somewhat better spreading creep qualities. Zinc chloride (corrosive) type flux is used, with subsequent washing to remove flux residue.

A solder containing 30 per cent tin, 2 per cent antimony, 1.25 per cent silver, and 66.75 per cent lead is used for soldering wiped joints. While it handles well, it is more susceptible to porosity than a 40 per cent tin, 60 per cent lead wiping solder.

It has not been found possible to change to low tin solders for every application. Soldering commutator-winding joints still requires 100 per cent tin solder. Such joints are subjected to moderately high temperatures for a soldered joint and are under high stress, demanding a solder with high temperature rupture properties. The necessity for use of a non-corrosive flux also limits the choice of solders to those which wet and flow readily with a rosin flux.

New Babbitt Alloys

Babbitt alloy, used in lining bearings, previously contained 83⅓ per cent tin, and 8⅓ per cent each of copper and antimony. Today's tin conservation order of the WPB restricts tin content in babbit to 12 per cent, except for implements of war, in which case high tin content babbitts are still permitted unless a lower tin con-

tent is practicable. The alloy used by the General Electric Company today contains only 1 per cent tin. The remainder consists of 15 per cent antimony, 1 per cent arsenic, 0.5 per cent copper, and 82.5 per cent lead. This composition is available from many metal producers.

This lead-base babbitt was subjected to tests in the G. E. laboratories and engineering departments, and is now generally used for all babbitted bearings except those on large turbine-generator sets, on guide and thrust bearings for vertical water-wheel generators, and for implements of war where high tin babbitts are specified. Field experience with lead-base babbitt for large turbine-generator sets and large vertical generators is being obtained.

Lead-base babbitt has been substituted for tin-base babbitt with no change in bearing design, and the lead-base bearings carry the same unit loads or pressure as did the tin-base babbitts.

CONSULTING DEPARTMENT

Speed Reduction for Motor Drives

When a low-speed machine is to be driven by an electric motor, what factors determine the type and method of drive?

There is a Place for Each Type

In selecting the type and method of driving a machine with an electric motor, the factors to be considered are size of the load, first cost of the motor, speed ratio desired, possible peak loads, the positiveness of the drive, the space available for the drive, the noise of the drive and the permissible level, the quality of the maintenance force on hand, the appearance of the coupled set and other factors governed by local conditions.

Direct Coupling: The simplest solution to the method of drive is undoubtedly direct coupling with an electric motor of the same speed as the machine to be driven. The most economical drive is usually at 1,800 r. p. m. High-speed motors are cheaper, operate at lower power losses, better power factor and higher torque than do slower speed motors. This difference in performance characteristics is more marked in the smaller sizes, particularly as to power factor. Increase of motor speed increases the cost of a motor due to features added to withstand higher centrifugal forces. On the other hand, low speed will result in high cost due to the greater flux and torque required and the resulting increase in size. This relation is shown in Horsepower $= K$ x torque x speed. For a given horsepower, if the speed is decreased, the torque must be increased. Torque may be increased by a higher investment in the windings to create the additional flux and in the steel to provide a suitable path for the added flux.

Direct drive with flexible or rigid coupling is often an economical solution with motors of 3,600, 1,800 or 1,200 r.p.m. motors of smaller sizes if the machine to be driven is designed to operate at the same speed. Larger motors, normally built at lower speeds, may also be economically coupled directly at lower speeds. In cases where the cost of the slower running motor would be prohibitive for direct coupling, belts, chains or gears must be used.

Belt Drive: This method of speed reduction is the least expensive. The maximum speed ratio is limited by the practical sizes of pulleys obtainable, belt embrace on smaller pulley and the practical distance between centers. Maximum speed ratios are limited to: 10 to 1 for fractional horsepower motors, 6 to 1 for ordinary sizes and 4 to 1 for sizes of 50 hp. and up. When the pulley diameter of the driven machine is fixed, the required speed ratio is obtained either by using a lower speed motor with normal pulley or an 1,800 r.p.m. motor with smaller pulley. As the diameter of the pulley is reduced, however, the strains on motor bearings and shafts are increased until the minimum permissible size of pulley is reached. Other factors to be considered are belt size, type and tension, number of belts and pulleys, slippage and the necessity of using idlers.

The application of properly adjusted, spring-loaded, pivoted motor base drive eliminates the necessity of close supervision and periodic belt take-ups.

Where the available space is limited, V-belts may be used. While costlier than flat belts, they require less maintenance, are less noisy, less dangerous and do not need idlers. V-belts must however be aligned more carefully as to parallelism of shafts and lateral misalignment to avoid unequal stretch, side wear and belt climbing. The limitation to the use of a V-belt is its stiffness in the larger sizes and its inability to adapt itself to the surfaces of smaller diameter sheaves as good as a light, flat double belt would. To be sure, a wider sheave with a greater number of smaller V-belts could be used, but that, at the expense of extending the center of the belt away from the bearing and producing an undesirable leverage on the bearing and shaft. Therefore, for large horsepower loads on higher speed motors, the use of V-belt must be avoided due to minimum pulley limitations.

Chain Drive: Beginning with speed ratios of 8 to 1, the use of silent chains becomes a possibility. Chain drive is also the solution where distant centers exclude the advisability of using a gear drive due to the resulting excessive pitch line speeds. Its use is most common in multiple drives to conveyor chains too long to be driven from a single point or other multiple drives. It is best suited for the transmission of heavy loads on short centers, at moderate and low speeds and without slip. Its use may also be necessitated by high temperatures, grease, oil, dust, steam or moisture saturated with corrosive fumes in sufficient quantities to prevent the use

Can you answer the following question? Suitable answers will be considered as contributions and will be published in a subsequent issue. If you have questions to ask, send them in also. Answers and questions should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, N. Y.

Do electrical contacts on starters and circuit-breakers burn away faster in air or in oil? Opinions seem to be contradictory.

of rubber or leather belts. Where the motor pulley diameter has to be so small that the bearings will not stand the tension of a belt drive, a chain drive may be the proper solution irrespective of the amount of power to be transmitted. For, with a chain drive, first, no tension is necessary in the slack side, and second, the chain sprocket may be placed close to the bearing, thereby reducing leverage.

In applying chain drive, the most important factors to be considered are size of load, size of sprockets, speed ratio, width of chain, chain speed and chain noise. While chain speed may be raised to as high as 1,500 ft. per min., for quietness and smoothness a chain speed of 600 ft. per min. should not be exceeded. Even at these speeds, however, a chain drive is usually noisier than a belt drive.

A disadvantage in the use of chain drives is the serious result of a failure at the chain hinges. This failure has the effect of increasing the chain pitch at that point and causing hammer blows on the sprocket teeth every time the defective spot goes around. The resulting jar may loosen and destroy bearing babbit in the shell, pound the shell loose in the motor end shields to the extent of wearing out the reamed opening too large for a standard replacement bearing. It is obvious that the motor windings would also suffer from the sharp jolts and have shorter life.

In view of the foregoing, the application of a chain drive should be carefully planned to avoid noise and vibration and then properly maintained to avoid failures and unnecessary damage to property. When chains are operated at low and moderate speeds, over pinions having adequate number of teeth, with worn out hinges promptly repinned with oversize pins, they operate as smoothly and satisfactorily as belts.

Gear Drive: Gears give an absolutely positive drive but are relatively more expensive. Having the possibility of much larger speed ratios, they cover a wider field than belts and chains. They are used where slip in the drive is not permissible. They are also preferred where belt breakage or chain failure would be dangerous. While the maximum speed ratio obtained from a pinion and gear is about 10 to 1 with a single set of gears, any ratio may be obtained by coupling together several sets of gears. Maximum pitch line speed of steel pinions with cut gears run open should not exceed 1,350 ft. per min. Due to rim speed limitations, the pinion diameter of the motor should not be smaller than half the diameter of the standard motor pulley. Gear drives are relatively more compact and therefore take up less space. In the production of noise, they compare favorably with the other types of drives, while some types of gear drives are remarkably noiseless.

Gear reduction units are of various types depending mainly on the speed ratio required, the capacity to be transmitted and the type of service. The types most commonly used are the single or two stage worm reducer, the single or two stage herringbone reducer, the single spur gear reducer and the gear train. In designing a gear drive, the factors to be considered are the capacity to be transmitted, speed ratio, gear sizes, pitch line speeds, available space and the permissible level of gear noise.

While some gear reducers are built on the motor end shield for compactness, the present day tendency of most economical use of material on motor frames resulting in less rugged construction together with the lack of flexibility of replacing a driving motor for repair and periodic overhauling make the use of a separate reducing unit more advisable. In stocking spare parts for replacement, it may also be important to consider that a gearmotor usually costs about twice as much as an 1,800 r.p.m. motor with belt drive. However, when confronted with the lack of adequate space and competent force of maintenance to properly care for troublesome belt drives, the choice invariably points to gearmotors. According to the severity of service, gearmotors are made for uniform loads, moderate shock loads and heavy shock loads.

When the ratio of speed reduction for a small or medium capacity drive is very large, a two-stage worm reducer is the best drive.

For small and medium capacity drives of large speed reduction ratio, the single worm gear may be used. Where price and definite shaft position are not controlling factors, the spiral bevel plus herringbone reducer or the double herringbone reducer results in a more efficient unit.

For smaller ratios of speed reduction and higher capacities, spur gears of various types may be used.

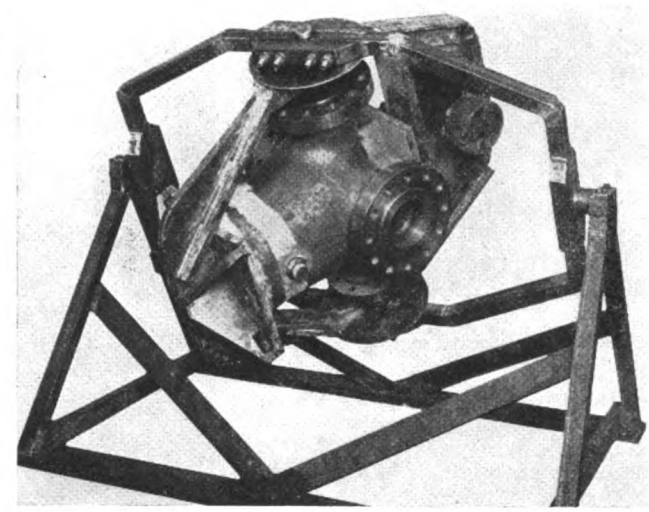
For still smaller ratios and larger capacities, the single or two stage herringbone and spiral bevel gear reducer are the proper drives.

Gear and Belt Drive: It may be advisable in some drives to follow a gear drive with a belt drive to obtain the total speed reduction. The advantages of such a drive are the possibility of change of speed ratio and cushioning of shocks by belt frequently protecting the gears and the driven machine against sharp and severe shocks.

In general, it may be stated that very little competition exists between belt drive and gear drive, especially in the higher speed ratios. Each is best suited for a particular field of application. The overlapping of the feasibility of application of either method of speed reduction occurs at a speed ratio of about 10 to 1, where flat belt with spring loaded pivoted motor base drive and gear drive are almost equally well suited, if the totally enclosed feature of the gear drive presents no added inducement.

R. G. Cazanjian
Supervisor
Triborough Bridge Authority
New York

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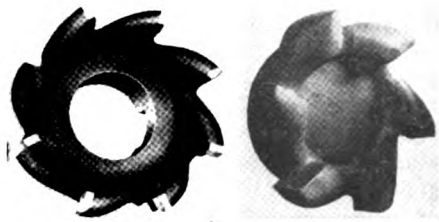


Gimbal-type welding positioner built of salvaged bar stock at the Erie Works of the General Electric Company

NEW DEVICES

Milling Cutter Bodies

Milling cutter bodies made of meehanite are produced by Farrel-Birmingham Company, Inc., Ansonia, Conn., for use in machine shops in making up cutters for various applications. They can be machined

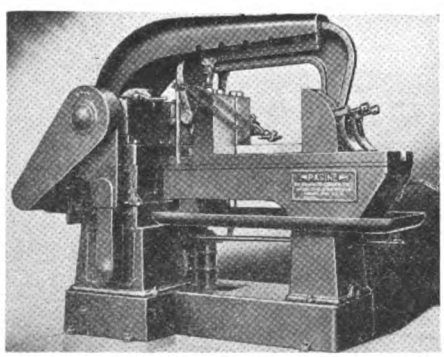


Cutter body blanks can be prepared for required milling operations

for carbide or cast-alloy tips within a broad range of rake and spiral angles. Users face, bore and slot the hubs as required, mill the tooth seats and braze on the desired tips. Meehanite has high damping capacity which permits high operating speeds with reduced chatter and longer tip life.

Heavy-DutyHydraulic Metal-CuttingMachine

The Racine Tool & Machine Company, Racine, Wis., has announced the development of a new 20-in. by 20-in. capacity metal-cutting machine known as their Model 36C. This machine has been designed primarily to provide low cost cutting with a thin cutting tool in large size materials. It is claimed that this machine



Racine hydraulic metal-cutting machine

is particularly adaptable to use on die block steel and other costly materials. The comparatively lightweight blade used removes only a small amount of metal in the form of chips, and where multiple cuts are made it is claimed a substantial saving results from this feature alone.

This machine is hydraulically operated, full control being placed on a single lever. A special dual-type feed is used which the manufacturer claims is an exclusive feature possessing novel advantages. It provides a fast-cutting speed in light materials and yet is arranged for a positive predetermined rate of cutting in die blocks, alloys and tool steel. A three-speed transmission provides cutting speeds of 55, 85 and 115 strokes per minute. A 3-hp. motor drive through V-belts is connected to the three-speed transmission by a twin disc clutch.

Reclining Coach Seat

Seats for coach passengers designed by the Edward G. Budd Mfg. Company, Philadelphia, Pa., to assure greater comfort are now undergoing tests on the Silver Meteor of the Seaboard Air Line. Four experimental seats with new foot and leg rests have been installed for the purpose of studying travelers' reactions.

The seat is patterned after a steamer chair. The footrest, in one position, serves as a hassock. It is pivoted on standards which rise a few inches from the floor and can be swung back against the front of the seat to furnish full-length support of the legs and feet of the reclining occupant. This enables the traveler to sleep on his side or to "curl up" and still have complete support for the knees and legs.

Each leg rest also contains a pocket into which can be placed for safety and convenience a woman's large pocketbook, shoes or small packages. The opening in this pocket is closed when the rest is in either the up or down position.

Another feature of the seat is the wide center arm rest which has been made the full width of the outer arm rest. Seat and footrest occupy 58½ in. of floor space.



The pocket in the foot and leg rest provides safe storage for pocketbooks or small packages

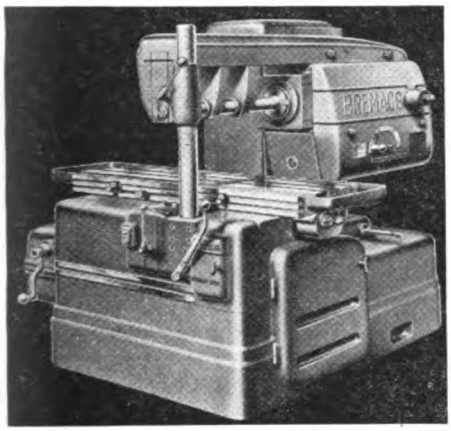


A coach seat which supports the reclining passenger from head to foot

Down Cut Milling Machine

The Model No. 4 milling machine with twin lead screws capable of down-cut milling on a precision, high-speed production basis is being built by the Bremacc Corporation, Detroit, Mich.

This machine uses two unsplined lead screws that are so connected in relation to each other that the effective bearing surface with the feed nut is constantly in tension by the use of a back-lash eliminator conventionally arranged outside the gear housing in the table. Axial play in the



Precision down-cut milling machine

thread shoulders of the lead screws is entirely avoided whether the table moves with or against the cutter in heavy feed or rapid traverse. A housing cast integral with the table, which carries all of the thrust loads, contributes to the sturdiness of this assembly.

Accuracy of the plane of travel of the work table is provided by two conventional dovetail ways. The rear slide is securely mounted and permanently fixed, while cross adjustment of the front slide is accomplished by means of adjusting screws without removal of the table, a method which avoids the necessity of taper gibbing. The slides receive lubrication from a gravity system, wick-fed by a large permanent reservoir passed into the table itself. The table is amply channeled and assures rapid disposal of cuttings, regardless of the accumulation. The coolant return is through a channel in the center at the rear side of the table.

The table feeds range from ½ in. to 30 in. per min. arranged by a change of pick-off gears. Rapid traverse has a standard table movement of 125 in. per min. Both table feeds and rapid traverse can be operated manually or automatically in either direction. Automatic reversing and jump feeds are also available which permits the use of work fixtures on both ends of the table.

The main gear box has two speeds, high and low range, in connection with spindle speeds. This provides a semi-quick change of the spindle speed, together with pick-off gears which are accessible through a hinge cover at the rear end of the spindle housing. All pick-off gears, both feed and speed, are splined and run in oil.

A heavy-duty disc plate clutch is used in the main gear box. A starting lever is within easy reach of the operator. Should the operation require the cutter to be stopped at the end of the cut, the operating lever is brought to neutral position. A safety lock permits the clutch lever to function only for the particular job for which it was originally set up. This interlocking, together with the safety feature provided at the starting button, eliminate any danger of the operator going into the wrong speed or the wrong cutter rotation.

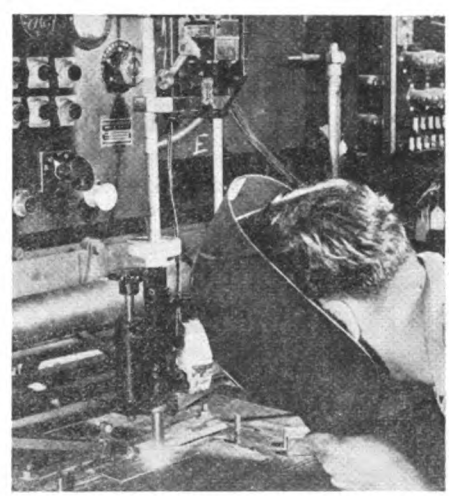
Power is supplied by an individual 10-hp. motor. The six-V-belt drive is adjustable for take-up. The motor is accessible, for service, repairs and lubrication, through a large hinged cover which has a lock-up handle.

Helium-Shielded Arc-Welding Machine

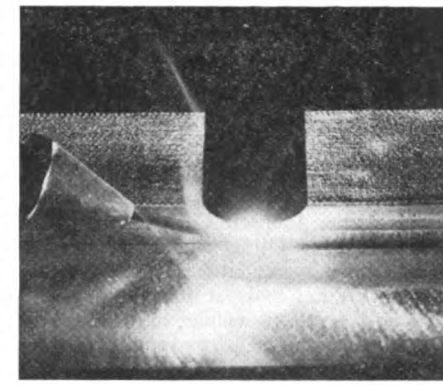
Both manual and automatic arc-welding equipment for the welding of magnesium, magnesium alloys, aluminum and other high-strength light alloys under a protective shield of helium gas, has been announced by the General Electric Company, Schenectady, N. Y.

The automatic machine illustrated incorporates an electronic motor control which enables the equipment to hold the proper arc-length even while the arc climbs and descends inclines, such as encountered in welding curved-surface parts. The filler metal is unreeled into the work at the correct angle through the small nozzle rod shown in the illustrations at the lower left. The tungsten electrode used to start and maintain the arc extends through the center of the rod that is perpendicular to the work and the helium gas is fed in around the electrode.

The rate at which filler metal is fed can



Automatic helium-shielded arc-welding equipment in operation—Electronic control panel at right controls arc length—Slanting tube (lower left) directs filler wire into the arc—All operations are controlled at panel at upper left —Tungsten electrode and gas nozzle are carried by the rod perpendicular to the work



Welding magnesium plate—Extremely accurate control of the rate of feeding the filler wire into the arc zone (through tube at left) produces the uniform bead contour shown at the right—The nozzle just above the arc surrounds the molten metal with a helium gas envelope

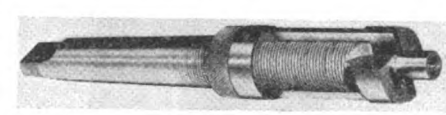
be adjusted to a constant uniform feed into the arc, or a supplementary control can be used to feed wire into the arc, withdraw it, and then feed it in again—all on a predetermined cycle.

The manual helium-shielded, arc-welding equipment has a specially designed electrode holder which is arranged to hold either a tungsten or a carbon electrode, to conduct the welding current to the electrode and to surround the electrode with a stream of helium gas. The source of direct-current power for both manual and automatic welding is a standard d.c. arc-welding machine.

Supplies of helium have been made available by the Bureau of Mines for welding, especially for use in war production. A number of distributors of compressed gases in different parts of the country are now obtaining helium gas from the Bureau of Mines for resale.

Spot Facer and Counterboring Tool

Forty-one standard sizes, with special sizes available on order, of a spot facer and counterboring tool with a cutter that can be removed quickly and easily for grinding are made by the J. M. Nash Company, 2354 North Thirtieth street, Milwaukee, Wis. The cutter in these tools is removed by loosening a knurled nut and cone nut after which the cutter is slipped back out of the bar. When re-sharpened, the cutter is replaced in the bar and centers itself when the cone is tightened and the knurled nut locked. Exact location is obtained by the web in the body which locates the fingers of the cutter, and the cone nut which centers the rear of the cutter on a straight line with the bar.



Cutters are easily removed from this tool for sharpening

Coolants Applied With Pressure Joint

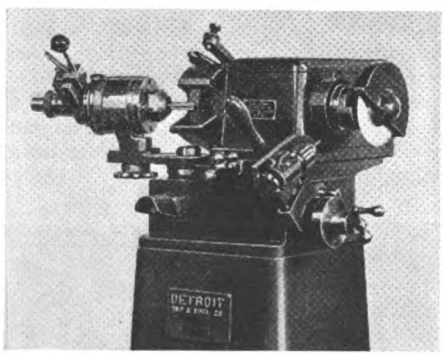
A rotary pressure joint designed to provide an adequate supply of cutting oil or coolant at the cutting surface in deep boring, drilling or reaming operations on cored castings or steel stock is manufactured by the Johnson Corporation, Three Rivers, Mich. Oil is admitted inside the spindle on a turret lathe and is conducted directly to the tools at the working end. In addition to providing lubrication the flow of lubricant helps to remove cuttings and turnings. Designed primarily for use on hand turret lathes the device can be adapted for application to other machines performing similar operations.

The pressure joint is a packless type of stuffing box or steam fit. Two carbon graphite rings are said to eliminate the need for packing and are self lubricating. Pressure within the joint is the sealing force and operates automatically to furnish as tight a seal as required. Provision is also made to compensate for vertical or horizontal misalignment. The device is said to have been adapted from successful applications made in admitting steam or liquids under pressure to rotating rolls of various types used in the paper-making and textile industries.

Tap Reconditioner

An improved design of its tap reconditioner has been developed by the Detroit Tap and Tool Company, Detroit (11), Mich. which includes a new spindle head that accommodates interchangeably a wide range of motor types. High rigidity for the spindle head and continuous adjustability for grinding-tool wear are obtained by mounting the spindle assembly on dovetail ways in the pedestal base.

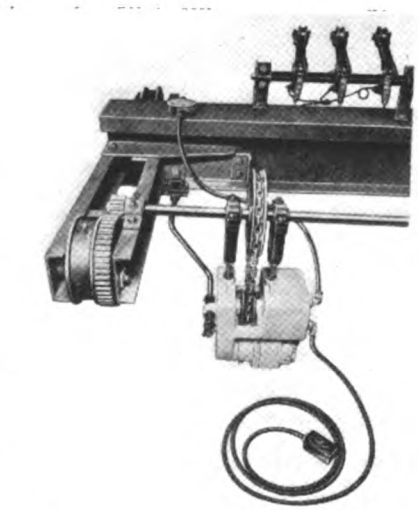
The tap chamfering unit is of the precision collet type and has also been changed to facilitate changing of taps and collets and assure maximum locating accuracy. It will accommodate collets from small machine-screw size up to the 1¼ in. standard tap shank size, including long-shank taper taps. Spiral pointing and spiral point polishing operations can be performed by integral units of the machine, the former driven from the new spindle.



Machine for accurate reconditioning of taps

Conversion Unit for Hand-Operated Crane

The bridge travel motion of hand operated cranes can now be converted to electric drive by the application of a complete self-contained electric-motor-driven unit known as the "Budgit Bridge Drive" being introduced by Manning, Maxwell and Moore, Inc., Muskegon, Mich. Installation on cranes is said to be possible within an hour without the need of machine work, drilling or fitting of parts.



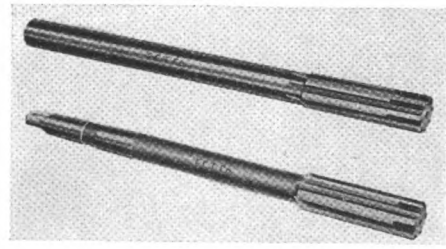
A motor-driven unit converts cranes from hand-operated to power-operated bridge travel

Cranes of either the single or double girder type of 10 tons capacity, or less, can be converted if the crane is of the geared type and operated by a chain wheel of 24 in. or smaller diameter. When equipped the cranes are controlled by a push button suspended by a cord to a convenient height above the floor level.

Hardened Shanks On Carbide Reamers

Standard sizes of carbide-tipped reamers with hardened shanks are being stocked by the Tungsten Carbide Tool Company, Detroit (6), Mich. The line comprises both straight-shank and tapered-shank types in sizes from ¼ in. to 1½ in. Up to 1 in. the reamers come in steps of 1/32 in.; above that the diameters change by 1/16 in. Reamers up to ½ in. are provided with four flutes, with six flutes for reamers from ½ in. to 13/16 in. inclusive, and with eight flutes in the larger sizes.

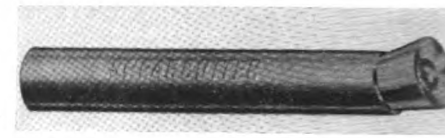
The entire shank is hardened to add strength and reduce shank wear. All tips are diamond ground with the outside diameter held to tolerances of plus 0 and minus 0.0003 in.



Shanks on these reamers have been hardened to increase strength and reduce wear

Circular Boring Tool

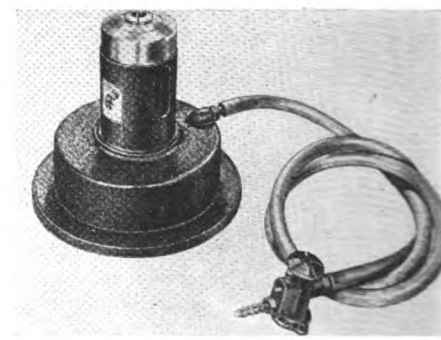
A boring tool intended for use on ordinary lathes which is said to approximate diamond boring machine results has been announced by the Shearcut Tool Company, Reseda, Calif. The tool has a circular cutting edge which is claimed to outlast straight edge cutting tools from 10 to 30 times before resharpening is necessary. Turning the bit in its holder provides a series of new cutting edges as they are required. It works well with either a positive or negative rake and permits working to close tolerances.



Boring Tool with circular cutting edge

Pneumatic Collet Fixture

A new precision collet fixture for drilling, milling and similar operations has been introduced by the Mead Specialties Co., Chicago. The unit is said to provide a powerful gripping action on round, hexagonal or square work pieces. Its maximum capacity is 1 in. round stock, 23/32 in. squares and ⅞ in. hexagonal pieces. The valve control may be mounted for foot operation or attached for automatic operation by the machine on which it is used.



Pneumatic holding fixture for drilling, milling or other operations

High Spots in

Railway Affairs . . .

To Help Indian Railways

Col. J. A. Appleton, Chief, Railroad Division, Transportation Corps, was formerly general manager of the New York Zone of the Pennsylvania Railroad. Early in the year he made a trip equivalent to a distance of one and a half times round the world, during which he saw American railroad equipment in operation in Egypt, India, North Africa and England. He has also visited the Alaskan railroads. Now he expects to spend several months in India at the invitation of the government of India. He will be accompanied by R. J. M. Inglis, divisional manager of the London & North Eastern of Great Britain. They will place their advice and experience at the disposal of the Indian Railway Administration.

Human Engineering

Prof. F. C. Lea of England, in making his presidential address before the Institution of Mechanical Engineers, contrasted conditions in the engineering world with those of fifty years ago. An outstanding engineer and educator, he naturally placed special stress upon the marvelous improvements that have been made in materials. Near the close of his address, however, he made this statement: "I am conscious that emphasis has been placed on knowledge, and on scientific and technical training. Only one brief reference has been made to character, and none to one of the most important of all engineering problems—I was going to say, that of controlling other men, but I would rather say, that of working in cooperation with them. In training both workers and staff, we must keep in view more than skill and technical efficiency. These must be supplemented by common sense, sympathy and judgment, all human qualities that can be fully developed only by a wider culture than science and technology can give."

Wartime Meetings

An important aspect of any progressive organization is the inspiration and practical suggestions and plans which develop from conferences or meetings to consider current problems and to plan ahead. This practice is even more important in wartime and under prolonged emergency than in normal times. For years the official staff of the Norfolk & Western has held get-together meetings, which have proved most effective in developing teamwork and cooperation, thus making for more efficient operation. Under war conditions these have been replaced by "meetings via radio." The third one of these was held on November 15, when a 30-minute broadcast was made from 19 radio stations in West Virginia, Virginia, Maryland, North Carolina, Tennessee and Ohio. The thousands of N. & W. employees who listened in were taken behind the scenes in the main shops at Roanoke, Va. Several of the shop craftsmen were interviewed "on the job," after which President W. J. Jenks was interviewed by the radio announcer. Needless to say, the sound effects in the locomotive shop interviews were real and not simulated. There was also an interview on the assembly line in the freight car shop where heavy repairs are made to coal cars, at the rate of 16 every eight hours.

Passenger Traffic Trends

The Bureau of Transport Economics and Statistics of the Interstate Commerce Commission has made a comparison of passenger traffic for the first six months of 1943, as compared to the first half of 1938. The revenues from coach business increased 500 per cent and those from parlor and sleeping car business 315 per cent. The average journey on the individual railway in the first half of 1943 was 107 miles per coach passenger, other than commutation, and 419 miles for those in parlor and sleeping cars. The corresponding 1938 averages were 50 and 267 miles. This record is all the more remarkable because of the great increase in freight traffic in recent years and the fact that very little new equipment has been available.

A Big Gamble

The railroads are absolutely essential to the winning of the war. They are carrying a record-breaking passenger and freight traffic with inadequate equipment. The WPB has been extremely conservative in granting the railroads priorities for materials and equipment and the railroad manpower situation has become exceedingly serious. It is, of course a fine problem to determine the proper balance in the supplying of material and manpower to the different branches of the armed services and to the essential war industries. It would appear that we face a grave danger by not properly protecting the railroads. Charles H. Buford, vice-president of the A.A.R., in testifying before a special Senate subcommittee investigating the railroad transportation situation, said that during 1942 and 1943 allocations of steel rail will "fall short of minimum replacement requirements by close to one million tons." He pointed out that increasing transverse fissure failures in rails testify to the apparent need for more liberal allowances of new rails. "The number of detected transverse fissures in rail more than doubled between 1939 and 1942, increasing from 13,822 to 28,316. The number of service failures increased by 23 per cent during the same period. The derailment of trains because of failure of rail and rail joints increased progressively from 290 in 1939 to 631 in 1942."

How Many Streamliners?

The Railway Age in its "Passenger Progress Annual—War and Post-War" lists the number of so-called "streamliners" now operating in the United States. No new trains of this type were installed in 1943. The 120 trains listed operate on 25 railroads. In six cases the daily mileage per train is in excess of 1,000. These trains, which enjoyed a relatively good earning capacity in pre-war days, are now earning from 200 to 300 per cent more than at that time. They are popular with the service men who want to make every minute of their furlough count, and with civilian travelers on urgent business.

What Lies Ahead?

This question was asked by Warren Kendall, chairman of the Car Service Division, A.A.R., in an address before the recent meeting of the American Railway Bridge and Building Association. "Those who are best informed on the subject," he said, "forecast that demands for freight transportation in 1944 will require that the railroads deliver about six per cent more ton-miles than in 1943. This may need revision upward, depending upon the supplies of rubber and gasoline and the progress of the war. It seems unlikely that it will be revised downward. No great amount of new equipment can be expected within the next 12 months—perhaps 40,000 cars. Possibly 1,000 new locomotives may be made available. With the prospects of increased demands for rail transportation, and no material increase in the availability of freight car equipment, it becomes evident immediately that the roads must do even more with what they have than has been done in the past. Director Eastman of the O.D.T. is calling for a 10 per cent increase in efficiency in handling cars. He is organizing committees to that end. Judging from past performances and from the known slack which still exists, the 10 per cent may not seem too high a mark at which to shoot. Personally, I have some doubt as to our ability to reach this rather extravagant objective. We should, however, try and do nothing less than our best. If we reach five per cent, or even three per cent, we shall indeed record a performance that will go down in history as remarkable."

Among the Clubs and Associations

EASTERN CAR FOREMEN'S ASSOCIATION.—Meeting January 14, 1944, 8 p.m., Engineering Societies building, New York. Speaker: A. J. Krueger, general superintendent car department, New York, Chicago & St. Louis. Subject: "Duties and Responsibilities of the Car Department in the Operation of Today's Railroad."

Car Maintenance

EASTERN CAR FOREMAN'S ASSOCIATION.—Meeting held October 8 at New York; Subject: Various phases of car maintenance. Speakers: F. R. Carlson, vice-president, Chicago Railway Equipment Company, Chicago; H. T. Casey, sales engineer, Symington-Gould Corporation, New York, and H. A. Ryan, general car inspector, Delaware, Lackawanna & Western. ¶ The subject of brake beam failures, causes and cures, was presented by Mr. Carlson. After directing attention to the fact that very often delays which, at first, are attributed to brake beam failures are found to have resulted from other causes without a record change having been made, he pointed out that brake beams must be considered as having moving parts which are constantly being subjected to stresses or to the corrosive action of the elements. In time, he said, they must wear out. "The best formula for reducing brake beam troubles," he continued, "is to adopt the best possible brake-beam equipment. That recommendation goes for good brake shoes, good spring brake-shoe keys, good supports and good parts of all kinds. The brake beam is a most important device on a car. In the location where it is required to function any failure is pregnant with trouble. Hence the brake beam is not only deserving of a daily spot in the limelight of the train-delay reports but it is deserving of every improvement which makes for safety, good braking, or minimized wear. To be sure, even the best beams require vigilance on the part of the inspectors, but beams built to the highest standards do not place upon the inspection forces so great a responsibility that only super-human performance could hope to meet that responsibility. Also, we should never forget that a beam once used, repaired, and put back into service will again be subjected to the identical stresses and strains which it had to meet when it was a brand new beam. Accordingly, the material which goes into a rebuilt or repaired beam should be every bit as good as the standard established for new beams. And, in replacing worn out parts, the work of rebuilding and testing should be as carefully and particularly done as when the beam was originally built." ¶Snubber springs and their relation to hot-box prevention was discussed by Mr. Casey. After explaining the essential functions of snubbers in breaking up the harmonic action of spring groups and particularly the effect which snubbers have through their action in protecting unsprung car weight—truck frames, brake rigging, brasses, axles and wheels— he indicated that tests had shown a decided reduction in the number of waste grabs on snubber-equipped cars. In one test made on a Class I Eastern road over a three-month period only 123 of 1,135 hot boxes occurred on snubber-equipped cars, a ratio of eight to one. The keeping of similar records was recommended to all who had the opportunity to make such a breakdown. Mr. Casey quoted a tank-car fleet owner all of whose equipment is snubber-equipped as follows: "I honestly believe that our records will sustain our claim that snubber springs are one of the biggest factors in obtaining these results." The results referred to were savings of 16.6 cents in maintenance costs to running gear per thousand miles of service. ¶ Mr. Ryan spoke on the preparation of cars at originating terminals. He emphasized the fact that adequate and well-trained supervision was a primary consideration inasmuch as final responsibility rested upon it. After reviewing the changes which have occurred in yard car handling over a period of years, until today a minimum amount of time is allowed for such work, he concluded with the statement that it is no longer a case of making sure that a car is fit to move from the yard but, so far as is humanly possible, making certain that the car is fit to move to destination.

Directory

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

ALLIED RAILWAY SUPPLY ASSOCIATION. — J. F. Gettrust, P. O. Box 5522, Chicago.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, H. H. Henline, 33 West Thirty-ninth street, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York.

RAILROAD DIVISION. — E. L. Woodward, *Railway Mechanical Engineer*, 105 West Adams street, Chicago 5.

ANTHRACITE VALLEY CAR FOREMEN'S ASSOCIATION.—James Duffy, general secretary, 200 Dudley street, Dunmore, Pa. Meets January, March, May, September and November at Scranton, Pa. February, April, October and December at Wilkes-Barre, Pa.

ASSOCIATION OF AMERICAN RAILROADS. — Charles H. Buford, vice-president Operations and Maintenance Department, Transportation Building, Washington 6, D. C.

OPERATING SECTION.—J. C. Caviston, 30 Vesey street, New York 7.

MECHANICAL DIVISION.—A. C. Browning, 59 East Van Buren street, Chicago 5.

PURCHASES AND STORES DIVISION.—W. J. Farrell, Exeutive Vice Chairman, Transportation Building, Washington 6, D. C.

MOTOR TRANSPORT DIVISION.—George M. Campbell, Transportation Building, Washington 6, D. C.

CANADIAN RAILWAY CLUB.—C. R. Crook, 4415 Marcil avenue, N. D. G., Montreal, Que. Regular meetings, second Monday of each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS.—J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, DeSoto Hotel, St. Louis.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—J. H. Stremmel, 6536 Oxford avenue, Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Ralph J. Feddor, 2803 North Campbell avenue, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month.

CENTRAL RAILWAY CLUB OF BUFFALO. — R. E. Mann, Room 1840-2, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday of each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMAN'S ASSOCIATION.—W. P. Dizard, 30 Church street, New York 7. Regular meetings, second Friday of January, February (annual dinner), March, April, May, October, and November at Engineering Societies Bldg., 29 West Thirty-ninth street, New York.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—H. T. Bramblett, care of H. P. Ruck, car foreman, Pennsylvania, 764 South Emerson avenue, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, in Indianapolis Union Station, Indianapolis, at 7 p. m.

MASTER BOILER MAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany 3, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings second Tuesday in each month, except June, July, August and September, at Hotel Vendome, Boston, Mass.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York 7. Meetings, third Thursday in each month, except June, July, August, September and December at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION. — E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings first Monday each month, except June, July and August, at Midway Club rooms, 1931 University avenue, St. Paul.

NORTHWEST LOCOMOTIVE ASSOCIATION. — G. T. Gardell, 820 Northern Pacific Building, St. Paul, Minn. Meetings third Monday of each month, except June, July and August.

PACIFIC RAILWAY CLUB. — William S. Wollner, P. O. Box A. Sausalito, Calif. Regular meetings, second Thursday of each alternate month at Palace Hotel, San Francisco, Calif., and Hotel Hayward, Los Angeles.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 308 Keenan Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY, FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, Room 811, Utilities Building, 327 South La Salle street, Chicago.

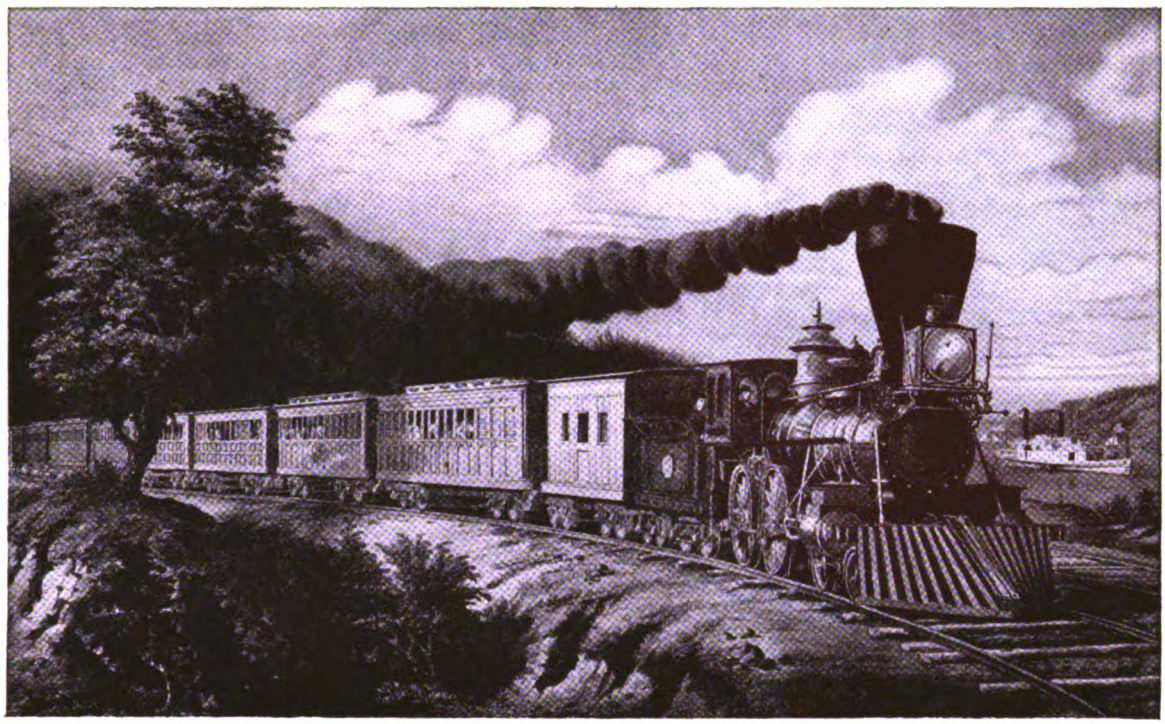
RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION —J. D. Conway, 308 Keenan Building, Pittsburgh, Pa.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, 4 Hunter St., S. E., Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July, and August at Royal York Hotel, Toronto.

WESTERN RAILWAY CLUB.—E. E. Thulin, executive secretary, Suite 339, Hotel Sherman, Chicago. Regular meetings, third Monday in each month, except June, July, August, September, and January, Hotel Sherman, Chicago.

(*Turn to next left-hand page*)



AMERICAN EXPRESS TRAIN

Greetings of the Season

TO ALL
RAILROAD MEN

—who have shown that the Railroad remains the nation's No. 1 carrier.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

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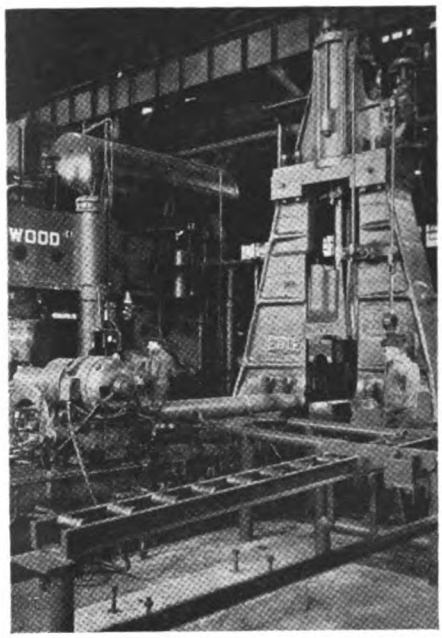
ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

3413

NEWS

Pittsburgh Steel Opens Hollow Axle Plant at Allenport, Pa.

THE Pittsburgh Steel Company opened its recently completed plant for the manufacture of hollow railway car axles at its Allenport, Pa., works to the inspection of a party of railway officers and press representatives on November 4. The plant,



The axle is mechanically rotated while the journal and wheel seat are formed under the drop hammer—Upsetting press in background

which is laid out in a continuous production line in which most of the movement and furnace temperatures are automatically controlled, is designed to turn out an average of 500 axles per day.

The Urshel-Pittsburgh hollow car axle was adopted as an alternate standard by the Mechanical Division, A. A. R., in 1941 in sizes from 4¼ in. by 8 in. to 6½ in. by 12 in., inclusive. [A drawing of the axle and the report made on it at that time appeared on page 287 of the July, 1941, *Railway Mechanical Engineer.*] The raw material for the axle is a seamless steel tube formed by the forging process on a Pilger mill from a pierced cylindrical billet. The rolls used to form the tubing are elliptical and they rotate in a direction opposite to the feed of the steel which is pressed against the rolls by a ram. The steel is fed forward by the ram when the pass between the rolls is wide. As the pass narrows, the rolls produce an effect similar to the blows of a forging hammer. Inside tube diameter is maintained by the use of a mandrel.

The tubes, cut to length, are taken to the axle plant where they are heated for upsetting and forging, one end at a time, in a continuous open-side heating furnace. The walls of the heated end are then increased in thickness in an upsetting press and the ends shaped to form the journals and wheel seats by a 3,000-lb. drop hammer. Each tube is then returned on gravity rollers to the charging end of the heating furnace through which it is again passed for heating and forming the other end. The formed axles pass to a continuous hardening furnace from which they move to combined straightening rolls and water quenching tank in which the ends of the tubes are plugged automatically so that the quenching takes place on the outside only. The axle next goes through a continuous draw furnace from which it is again quenched. The ends are then simultaneously cut to length and centered.

The axles are designed to be machined to the same journal and wheel-seat dimensions as the conventional types of solid axles. They are completely interchangeable with solid axles and can be machined on the usual types of lathes adding suitable fittings for centering the tubular material.

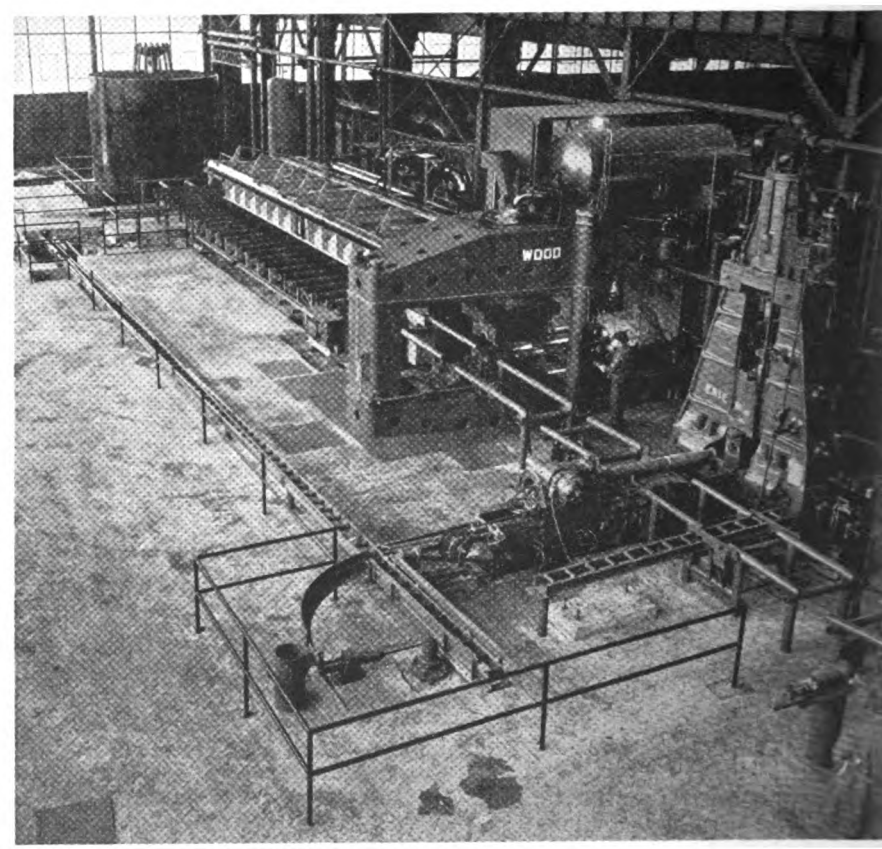
Between the wheel seats the axles are straight and are left with the finish produced by the Pilger mill operation. The only difference in the outside dimensions is in the portion between the wheel seats, since the tubular axles do not have the fillet and the subsequent taper toward the center, which is typical of solid axles.

The axles were subjected to two types of tests. The first consisted of distortion or bending tests to determine stiffness under various loads. In these tests, collars were fitted on the wheel seats with the same tolerances with which wheel press fits are made. It was found that the deflection of tubular axles was less than that of solid axles under equivalent loads. In the solid axles, failure through permanent distortion began at 169,000 lb. and continued as the loads were increased. Actual yield occurred at 225,000 lb. to 226,000 lb.

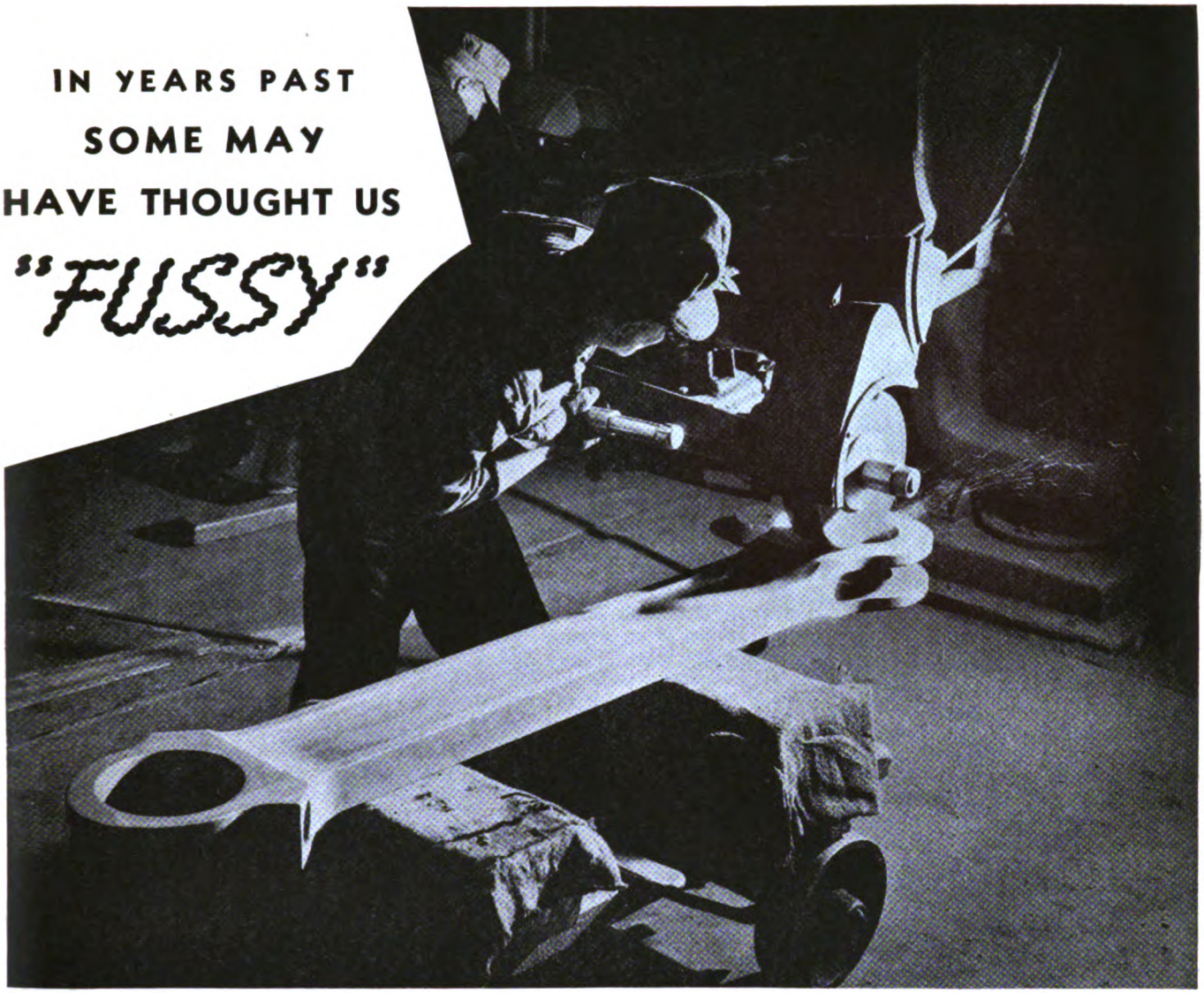
For tubular axles, loads of 369,600 lb. to 431,000 lb. were required to set the structures permanently. This indicated 56 per cent greater strength for the tubular axles over the solid axles before plastic deformation developed.

Comparative fatigue tests were conducted at the Timken Roller Bearing Company's laboratory before the axle was adopted as an alternate standard. In these tests the tubular axle withstood 88,000,000 reversals

(*Continued on next left-hand page*)



A partial view of the hollow axle plant of the Pittsburgh Steel Company—To the rear of the upsetting press is the continuous tube end heating furnace—At the right foreground is the drop hammer which forms the journal and wheel seat



BUT WE DON'T THINK THEY DO, TODAY!

In the belief that no railroad could ever get more out of a locomotive than had been built into it by its maker, we have always insisted on the very highest standards in our design, our workmanship, and our selection of materials. We have carried our care in these regards to a degree which may have caused some to consider us over-careful—even 'fussy'.

But today, with war traffic stressing all rolling stock close to its limit of endurance, Lima-built locomotives are proving the value of Lima's unceasing search for perfection. Long are the miles and heavy the load, but Lima-built Modern Super-Power Steam Locomotives have what it takes to 'take it'—and they're proving this from coast to coast.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED INCORPORATED, LIMA, OHIO

of a unit stress of 19,000 lb. as compared with 875,000 to 2,755,000 stress reversals of the solid axles. Tests have also demonstrated the greater stiffness of the hollow axle under various loads and that it can be subjected to much higher loads before taking permanent set than can the solid axle. The 5-in. by 9-in. hollow axle weighs 177 lb. less and the 6½-in. by 12-in. axle 510 lb. less than the corresponding standard solid axles.

A.S.M.E. Honors Budd, Sillcox and Wright

THREE men well known in the railroad and railroad supply industries are among those upon whom honors were conferred at the annual meeting of the American Society of Mechanical Engineers held at the Pennsylvania Hotel, New York, November 29-December 3. The bestowal of honorary membership on Ralph Budd, president, Chicago, Burlington & Quincy, was made with the citation: "Forty years a railroader; a pioneer in the development of Diesel-powered lightweight trains; civil engineer and executive; builder of railroad structures and railroad organizations; president of the Burlington Lines." Roy V. Wright, editor of the *Railway Mechanical Engineer*, received honorary membership as an "International authority in railroad engineering oft-honored as author, editor, publisher, teacher, statesman, an amiable competent crusader for social and civic responsibilities of the engineer."

Lewis K. Sillcox, senior vice-president, New York Air Brake Company, received the A.S.M.E. Medal as an "Eminent engineer, executive, distinguished lecturer, beloved gentleman and a lover of wisdom, for his preeminent and permanent contributions to the art and science of engineering, of transportation, of education, and the fine art of living. And for his ingratiating, inspiring influence upon the lives of men." This medal is presented by the society "for distinguished service in engineering and science." It may also be awarded for general service in science having possible application in engineering.

Honorary membership, to which persons of acknowledged professional eminence are elected by unanimous vote of Council, was also bestowed upon Edward N. Trump, senior member in the firm of E. N. & C. C. Trump, Syracuse, N. Y.; and Francis B. Blossom, partner in the firm of Sanderson & Porter, New York.

The Worcester Reed Warner Medal, a gold medal bestowed on "the author of the most worthy paper received dealing with progressive ideas in mechanical engineering or efficiency in management," was presented to Igor Ivan Sikorsky, Vought-Sikorsky Aircraft, Stratford, Conn.

The Holley Medal, bestowed for "some great and unique act of genius of engineering nature that has accomplished a great and timely public benefit," was received by Vannevar Bush, president, Carnegie Institute of Washington, Washington, D. C.

The Charles T. Main Award, an annual cash award of $150 for "the best paper within the general subject of the influence of the profession upon public life," the exact topic being assigned by the Board of Honors and Awards, went to Mitchell C. Kazen of the University of Detroit, tool designer, Cook Engineering Company, Detroit, Mich.

Troels Warming, mechanical engineer, Nordberg Manufacturing Company, Milwaukee, Wis., received the Junior Award, an annual cash award of $50 presented for "the best paper or thesis submitted by a Junior Member."

William L. Hutton of Princeton University, Ensign, U.S.N.R., was presented with one of two Student Awards of $25 each established for "the best papers or theses submitted by Student Members" in undergraduate and post graduate work. Mr. Hutton is an undergraduate.

Lag in Fitting AB Brakes Is Cause of Admonition

THE concern of the Interstate Commerce Commission over the continued operation of large numbers of freight cars equipped with the type K brake has again been expressed, this time in a report, prepared under the direction of Commissioner Patterson, of the investigation of an accident on the Pennsylvania near Slope, Pa., on September 10.

The accident originated in the derailment on a descending grade of two cars of a 120-car train of empty tank cars and was complicated by the involvement of two other trains passing on parallel tracks which had been fouled by the derailed cars. The commission's investigation disclosed that only 10 of the 120 cars in the train were equipped with standard AB brakes, and that these cars were "distributed throughout the train so that important advantages of the AB type of brake equipment, namely, faster serial action, emergency after service and reduction of shock from initial application, were not available."

According to the report, the accident was caused by an "insufficient number" of cars being equipped with "adequate power brakes to control safely movement of the train." The report recommended "that a sufficient number of cars equipped with AB brakes be included in each train, properly spaced so that the movement of the train can be safely controlled by the train brakes."

No railroad-owned cars were included in the equipment of the derailed train. Ownership of the cars in the train was divided among 18 private car operators, and only 16.6 per cent of all cars of these 18 private car owners had been equipped with AB brakes up to June 30, the report pointed out, as compared with 60.6 per cent of all of the Pennsylvania's cars so equipped, although 85 per cent of the 10-year period allotted for application of the new standard brake had then elapsed.

Miscellaneous Publications

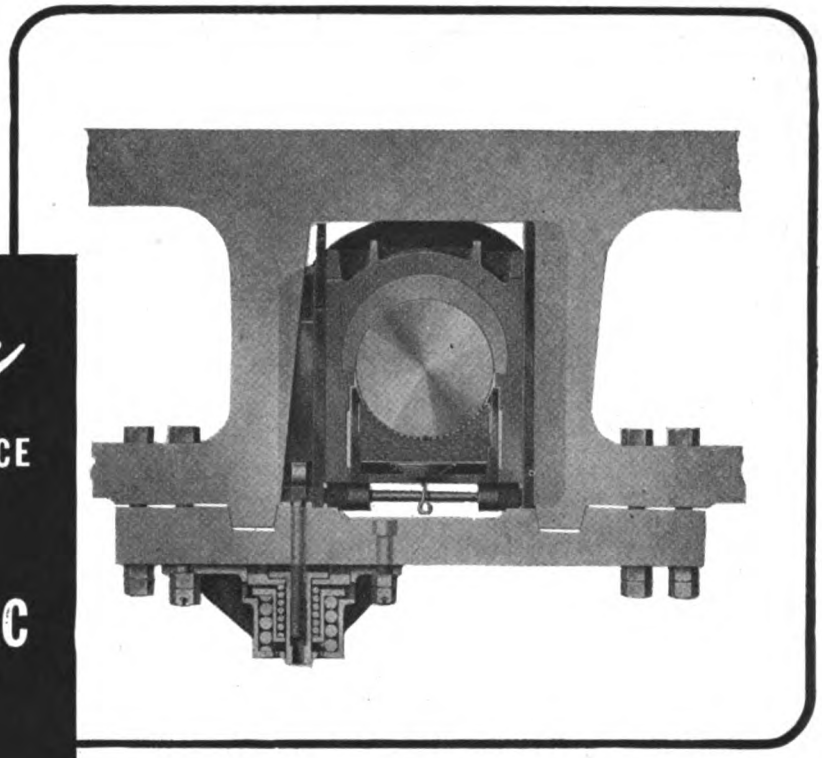
PIPE AND TUBE-BENDING HANDBOOK.—The Copper & Brass Research Association, 430 Lexington avenue, New York 17, has prepared an 80-page handbook on practical methods for bending pipe and tubes of copper, brass and related alloys. This work is divided into two classifications: (1) the routine bending of pipe and tube of relatively small diameter for a wide variety of commercial assemblies and installations, and (2) the specialty bending of large diameter tube for particular applications. The data and illustrations have been gathered from a variety of sources and, as nearly as practicable, where authoritative sources have been used, the full text of the original statements has been preserved. Twenty-four pages contain tabulated data on weights of seamless tubes of copper, brass and related alloys. There are several other pages of tables of standard pipe sizes; tables to determine sizes of Type K copper water tube for cold water service lines; flow through standard pipe size copper and brass pipe, etc.

A. A. R., Mechanical Division

LETTER BALLOT

CIRCULAR No. DV-1053, issued by the secretary, Mechanical Division, Association of American Railroads, on October 26, announces the results of the Letter Ballot on 14 propositions which, under authorization of the General Committee of that division, were submitted to letter ballot on September 8. All of the proposals were adopted by large majorities of the ballots cast. They were as follows: (1) to advance to standard the present optional tie bar construction between the top toes and the bottom toes of the brake head for the No. 15 brake beam; (2) to adopt as recommended practice a form of card for listing data with respect to HSC air-brake equipment on passenger cars, in lieu of stenciling each item; (3) to revise the standards for lettering and marking of cars to include requirements for marking of freight equipment cars that are leased or are in special service, to indicate the point to which the car is to be returned when empty; (4) to modify the fusion and bronze welding regulations with respect to building up eyes of brake-beam hangers; (5) to clarify the fusion and bronze welding regulations with respect to welding of cast-steel bolsters; (6) to modify the fusion and bronze welding regulations to prohibit welding parts of inadequate design or made of defective material; (7) to modify the standard location of angle cocks; (8) to adopt as standard, waste retainer ribs for passenger and freight journal boxes of Classes C, D, E and F; (9a) to adopt as recommended practice designs of boiler studs; (9b) to add material reference to drawing covering cylinder and valve-head studs shown on page F-12 of the A. A. R. Manual; (10) to adopt as recommended practice designs for locomotive sanding systems for various types of locomotives; (11) to adopt as recommended practice pedestal jaw openings required for friction bearing journal boxes for steam, electric and Diesel locomotives and tenders; (12a) to adopt as recommended practice bushings thicknesses in relation to crank-pin diameters for various types of bushings on main and side rod ends; (12b) to revise page F-10 of the A. A. R. Manual for the purpose of clarifying the stress limitations and provide a limit for reboring of rod ends;

(Continued on next left-hand page)



Save Manpower

INCREASE LOCOMOTIVE SERVICE

USE THE

FRANKLIN AUTOMATIC COMPENSATOR and SNUBBER

This important Franklin device releases manpower and increases the availability of your locomotives. Instead of calling for the services of scarce and more needed skilled maintenance men, it compensates *automatically* and *continuously* for all alterations caused by driving box temperature changes, and also dampens the stresses induced by reversal of forces.

By eliminating the air gap and by dampening stresses, the Franklin Automatic Compensator and Snubber greatly prolongs bearing life and increases locomotive mileage between shoppings. It has never been so important to keep every locomotive working to its utmost as it is today!

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

(13) to revise page F-6A of the A. A. R. Manual to include sizes of dry pipes and outside steam pipes now appearing in material specifications M-108; (14) to revise specifications M-108 covering boiler tubes, to eliminate reference to dry pipes and steam pipes.

The first two propositions were recommended by the Committee on Brakes and Brake Equipment; Nos. 3 to 8 came from the Committee on Car Construction; Nos. 9 to 13, inclusive, were submitted by the Committee on Locomotive Construction, and No. 14 is the recommendation of the Committee on Specifications for Materials. With the exception of No. 11, the proposals all go into effect on January 1, 1944. Inclusion of No. 11 in the Manual of Standard and Recommended Practice is being held in abeyance pending further consideration by the Committee on Locomotive Construction.

Thickness of Journal-Bearing Lining Increased

By action of the Association of American Railroads, Mechanical Division, as announced in a circular letter issued by Secretary A. C. Browning, the A.A.R. emergency design of journal bearing has been modified by increasing the lining thickness from the present nominal of ⅛ in. to a new nominal of ¼ in., maintaining the same tolerances for H and P dimensions as heretofore (plus or minus 1/32 in.).

A revised drawing, which accompanied the letter, is supplied to supersede the present emergency design drawing in the Manual of Standard and Recommended Practice. Table II of the specifications for relined journal bearings has been revised as shown in the accompanying table.

Crown Thickness of Relined Bearings—Finished Dimensions After Broaching

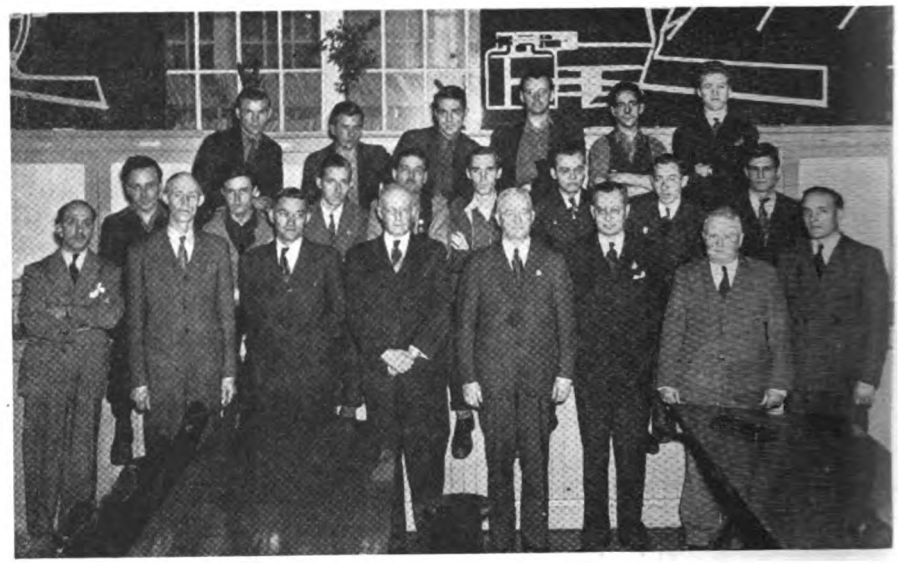
Journal size, in.	Total thickness, in.
3¾ by 7	15/16
4¼ by 8	15/16
5 by 9	1 1/16
5½ by 10	1 1/16
6 by 11	1 3/16
6½ by 12	1 3/16
Tolerances	Plus or minus 1/32 in., all sizes

Canadian Pacific Apprentices Honored at Angus

Prizes for outstanding work during the past year were awarded 23 apprentices at the Angus shops of the Canadian Pacific at Montreal, Que., on October 22. Ten of the winners were "repeaters" who had won prizes in one or more previous competitions. The ceremony at Angus was the first of a series which will take place in the Ogden shops at Calgary, Alta., where naval guns are being made; in the Weston shops at Winnipeg, Man., and in the various back shops.

The training course covers a period of five years, during which time there is a weekly school period eight months each year. The apprentices are transferred from main to back shops and vice-versa to round out their education in the 25 different crafts they learn as machinists, boilermakers, blacksmiths, sheet-metal workers, electricians, painters and carmen. Work on tanks, guns and munitions is also a part of the training.

H. B. Bowen, chief of motive power and rolling stock, is in charge of the apprentice system in which 500 are enrolled.



Some of the winners in the twenty-third annual scholarship competition of the Canadian Pacific apprentice system at Angus shops

Left to right, *back row:* W. Rezanowich, J. F. Rivet, J. Thibodeau, R. Dubois, C. Dupont, R. D'Amour.—*Middle row:* T. Betuik, M. Alexandre, F. Parrett, V. Mandeville, F. W. Thoburn, J. Dzamka, J. P. Lessard, R. Mouton.—*Front row:* R. Lucciasano, Charles Bulley, (classroom instructor), B. Faughnan (assistant works manager, car), D. L. Thornton (assistant works manager, locomotive), H. R. Naylor (works manager), T. F. Donald (assistant works manager, munitions), Hugh Shea (shops instructor), and L. Huneault.

"Welding Stainless Steel," an Allegheny-Ludlum Film

A 16 m.m. full-color sound film, "Welding Stainless Steel," has recently been completed by the Allegheny-Ludlum Steel Corporation, Brackenridge, Pa. The purpose of the film is to serve as an aid in teaching welding students, as well as welders familiar with carbon-steel welding, the fundamentals of working with stainless steels. The process is explained in simple terms, and close-ups of the arc at work greatly magnify the action of the protective flux and the melting of the rod metal.

Supply Trade Notes

Standard Stoker Company.—*J. B. MacKenzie,* formerly development engineer, has been appointed mechanical engineer, and *E. F. Seibel,* formerly chief draftsman, has been appointed assistant mechanical engineer of the Standard Stoker Company, with headquarters at Erie, Pa.

◆

Westinghouse Electric & Manufacturing Co.—*Peter L. Lenz,* formerly manager of the Pittsburgh, Pa., homewood manufacturing and repair plant of the Westinghouse Electric & Manufacturing Co., has been appointed manager of the Middle Atlantic district manufacturing and repair department with headquarters in Philadelphia, Pa. His new duties will include general supervision of two manufacturing and repair plants in Philadelphia and one each in Wilkes-Barre, Pa., Huntington, W. Va., and Baltimore, Md.

◆

Gustin-Bacon Manufacturing Company.—*J. F. Stephens,* general manager of the industrial department of the Gustin-Bacon Manufacturing Company, has been elected a vice-president of the company.

◆

United States Electrical Tool Company.—*Joseph D. O'Flaherty* has been appointed assistant manager in charge of sales and promotion for the United States Electrical Tool Company, Cincinnati, Ohio. He was formerly branch manager of the Schacht Motor Company, Columbus, Ohio, and for 13 years was sales manager of the Diamond-T Truck Company of Cincinnati.

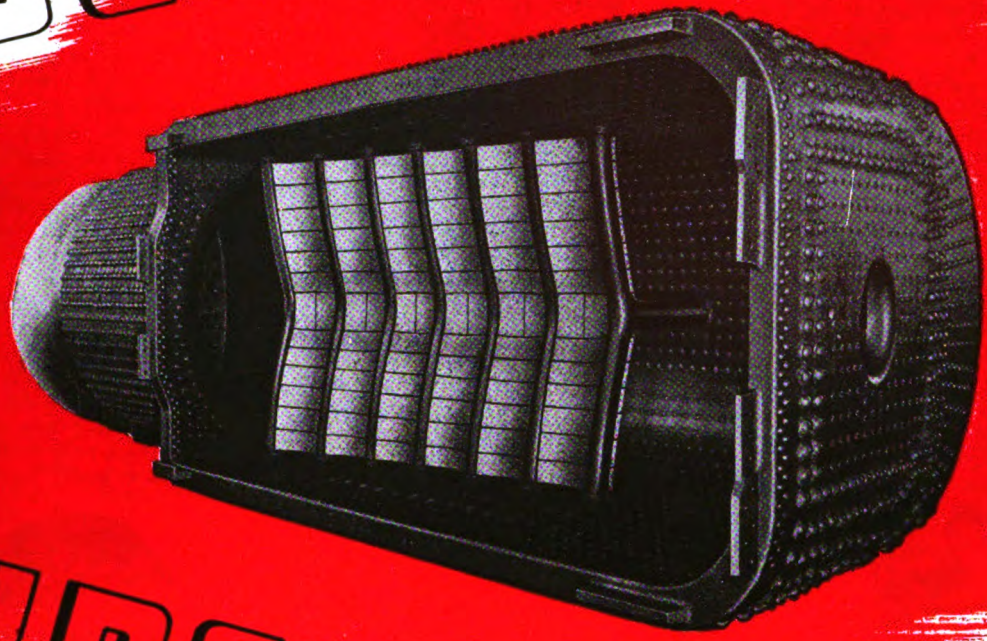
Al. H. Kohnen, formerly associated with the Estate Stove Company, Hamilton, Ohio, has been placed in charge of the company's Pittsburgh, Pa., office.

◆

Baldwin Locomotive Works.—*John C. Graf* has been appointed sales manager of the hydraulic press and special equipment department of the Southwark division of the Baldwin Locomotive Works. Following his graduation from Temple University, Mr. Graf was associated for two years with the Link Belt Company and later with the

(*Continued on next left-hand page*)

SECURITY



CIRCULATORS

- for increased locomotive availability
- for better Arch Brick support
- for Positive Flow of Water over CENTER of Crown Sheet
- for Reduced Honeycombing
- for Reduced Flue Plugging
- for Reduced Cinder Cutting

AMERICAN ARCH COMPANY, INC.

60 East 42nd Street, New York 17, N. Y.

SECURITY CIRCULATOR DIVISION

Camden Iron Works of R. D. Wood & Company. He joined the Southwark Foundry & Machine Co., now the Baldwin Southwark division, in 1915, serving as draftsman, expediter, inspector, purchasing agent and salesman and was appointed New England sales manager in 1925, the position he held prior to his new appointment.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION.—*J. M. Darbaker,* general superintendent of the Carnegie-Illinois Steel Corporation, Chicago, has been promoted to assistant manager of Chicago district operations to succeed *R. G. Glass,* who was elected vice-president and general manager of the Geneva Steel Company, Provo, Utah.

◆

AMERICAN CAR AND FOUNDRY COMPANY.—*William L. Stancliffe,* vice-president in charge of miscellaneous sales and munitions, has been appointed vice-president in charge of sales of the American Car and Foundry Company, to succeed the late *William E. Hedgcock.* He will continue to handle contractual relations between the company and the U. S. government having to do with the manufacture and sale of munitions of war. Mr. Stancliffe's early business training began with contracting engineers, and he took



William L. Stancliffe

part in the construction of many well-known projects including the College of the City of New York and the Hell Gate Bridge. He later joined the Traylor Engineering & Manufacturing Co., serving as a member of the sales staff for a number of years. When the American Car & Foundry Motors Co. was formed in February, 1926, Mr. Stancliffe became its vice-president in charge of motor coach sales. He was transferred to the operating department of the American Car and Foundry Company in February, 1932, and appointed manager of miscellaneous sales in March, 1939. He subsequently was elected vice-president in charge of miscellaneous sales and munitions.

◆

HOUDAILLE-HERSHEY CORPORATION.—*Alfred C. Ryan,* former member of the executive staff of the Universal Credit Company who has been serving with the War Production Board since November, 1942, has been appointed director of sales of the Houde engineering division of the Houdaille-Hershey Corporation.

AMERICAN ARCH COMPANY.—*J. D. Brandon* has been named vice-president in charge of sales of the American Arch Company, with offices in New York and Chicago. Mr. Brandon began his career with the New York Central in 1906, serving his apprenticeship at the railroad's Beech Grove, Ind., shops. He was foreman and general fore-



J. D. Brandon

man of the Urbana, Ill., enginehouse of the Peoria & Eastern from 1912 to 1915 and general foreman of the American Brake Shoe & Foundry Company from 1915 to 1919. He joined the American Arch Company in 1919, leaving in 1924 to become associated with the Pittsburgh Steel Products Company. In 1927 he rejoined American Arch as assistant to the executive vice-pres.

◆

HANDY & HARMAN.—*John B. Ross,* formerly with Linde Air Products Company has been appointed to the West Coast engineering office of Handy & Harman. Mr. Ross will serve West Coast industries and shipyards in the capacity of brazing engineer in the application of Handy & Harman's silver brazing alloys and other precious metal products. Mr. Ross is a graduate of the University of California where he was employed for some time on advisory work. Following this, he went with a large Western oil company and finally became associated with the gas consuming apparatus field which he has served since 1925. In his new appointment, Mr. Ross will make his headquarters at the Los Angeles, Calif., office of Handy & Harman which serves California, Washington and Oregon.

Army-Navy "E" Awards

Bullard Company, Bridgeport, Conn. Third. award.

Davenport Besler Corporation, Davenport, Iowa. November 3.

Fitzgibbons Boiler Company, Oswego, N. Y. October 29.

Hazard Insulated Wire Works, a division of the Okonite Company.

Link-Belt Company, Chicago. October 7.

Philco Corporation, Trenton, N. J. Second award.

Whiting Corporation, Harvey, Ill. Second award.

AMERICAN LOCOMOTIVE COMPANY.—*Robert B. McColl,* vice-president in charge of manufacturing of the American Locomotive Company, has been elected a director.

◆

ALLEGHENY LUDLUM STEEL CORPORATION.—The Allegheny Ludlum Steel Corporation, Brackenridge, Pa., has announced the acquisition of the Carbide Alloy Corporation of New York, which will be operated as Allegheny Ludlum's Carbide division.

◆

DAVIS BRAKE BEAM COMPANY.—*George W. Fox,* formerly secretary, has been elected president of the Davis Brake Beam Company, Johnstown, Pa. *David E. Shannon* has been elected vice-president and *O. G. Custer,* assistant secretary.

◆

ELASTIC STOP NUT CORPORATION.—*Luther H. Atkinson* has been appointed vice-president in charge of sales of the Elastic Stop Nut Corporation. Mr. Atkinson was formerly vice-president in charge of marketing for the Weyerhaeuser Sales Company, St. Paul, Minn.

◆

GOULD STORAGE BATTERY CORPORATION.—*W. H. Radeke* has been appointed service manager of the Gould Storage Battery Corporation at Depew, N. Y. Mr. Radeke has been a Gould service engineer in the Chicago area for the past seven years. For seventeen years prior to that he was active in the public utility field, specializing in



W. H. Radeke

lead acid storage service. During World War I, Mr. Radeke was in the United States Naval Electrical School Submarine Base, New London, Conn. After finishing the course, he was transferred to duty in the Submarine Base, San Pedro, Calif. Because of this wide experience in submarine storage battery operations, he will in the future personally contact east coast naval bases for installation work and service on Gould batteries in use by the Navy.

◆

AMERICAN BRAKE SHOE COMPANY.—*Joseph B. Terbell* has been appointed first vice-president of the American Manganese Steel division of the American Brake Shoe Company. Mr. Terbell was graduated from

(*Continued on fourth right-hand page*)



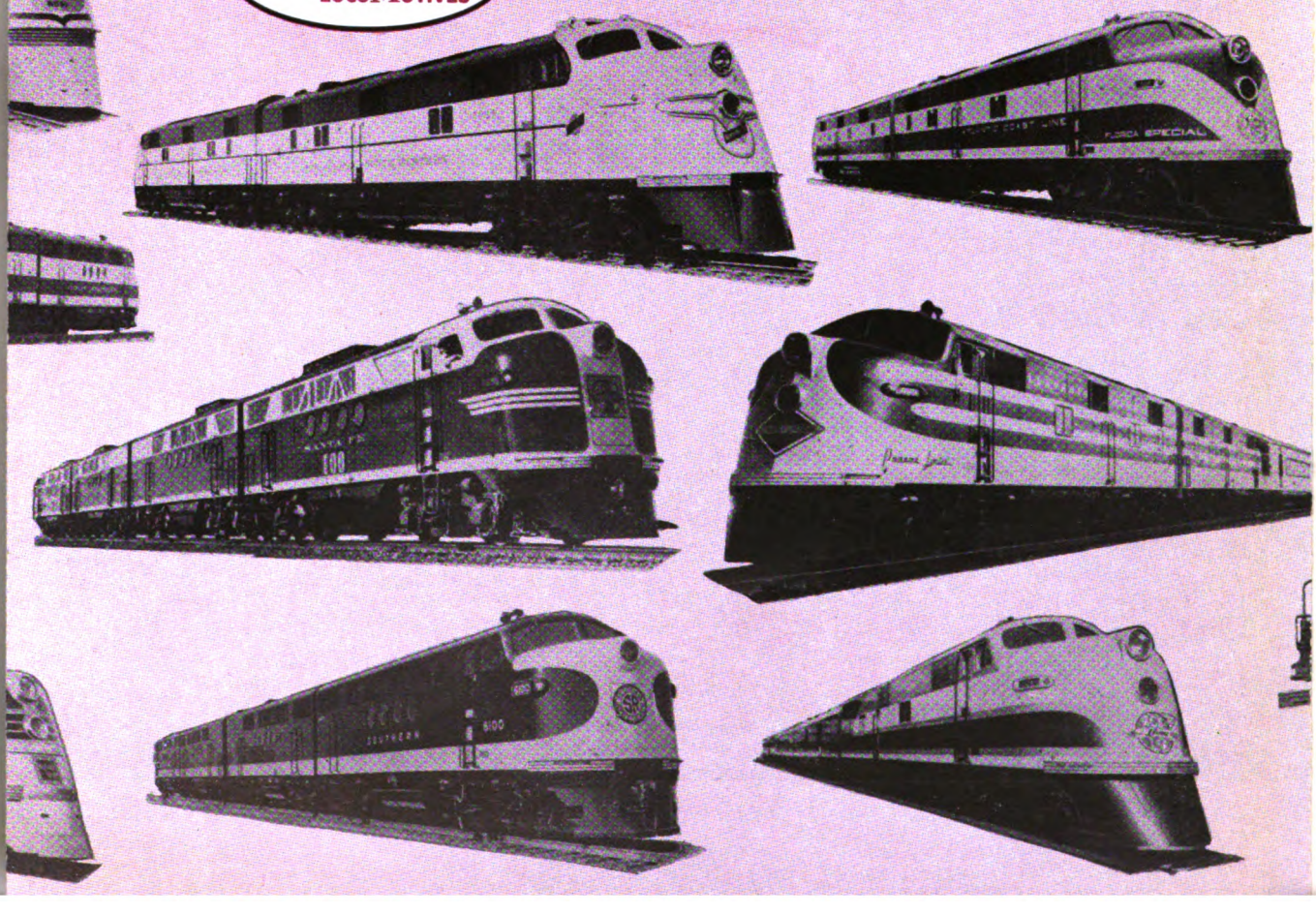
Mainline Operation

Farsighted operating officials continue to order Diesel locomotives to rehabilitate war worn motive power pools, in preparation for the heavy post-war job. For the unprecedented loads of wartime have thrown the advantages of General Motors Diesel Locomotives into high relief, such advantages as:

Power for hauling greater tonnage and reducing or eliminating helper service...
Speed for faster schedules...
Flexibility for meeting varying traffic conditions...
High availability with minimum "time-outs" for servicing and repairs...
Economy in lower fuel costs, elimination of expensive supporting services, lower track maintenance, fewer fuel and water stops which speeds up schedules, smoother starts and stops resulting in greater protection to cars and lading and greater comfort to passengers...

GM Diesel Power has very definitely proved its superiority in all classes of service. The full potential savings which follow the complete Dieselization of an entire railroad, or section of railroad, can now be realized. Expensive supporting services which are not required for Diesel operation can now be gradually reduced and finally eliminated—damage and repairs to track and bridge structures will be materially reduced—and fewer locomotives will be required to meet the heavy traffic demands of the post-war era.

GENERAL MOTORS
LOCOMOTIVES





In Yards and Terminals

Time and tonnage gains in mainline operations can be quickly nullified by congestions in yards and terminals. GM Diesel switchers, with their proved ability to keep yards clear with no "bottlenecks", and with outstanding economies, become the perfect complement to GM Diesel road power. Designed for smooth starting and stopping, GM Diesel switchers provide maximum protection to equipment and lading and comfort to passengers.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILLINOIS, U. S. A.

GENERAL MOTORS LOCOMOTIVES

RAILWAY AGE, NOV. 20, 1943
RAILWAY MECHANICAL ENGINEER, DEC., 1943

the Sheffield Scientific School of Yale University in 1928, and joined the American Manganese Steel division in October of that year. After serving an apprenticeship of about two years in the company's Chicago Heights plant, he entered the Chicago



Joseph B. Terbell

sales office. He was transferred to the Ramapo-Ajax division in 1931, and to the American Manganese Steel division's New York office in 1932. He moved to St. Louis, Mo., as assistant manager of the alloy department in 1933, and to the sales department in Chicago in 1935. He was transferred to the American Forge division in 1936, returning to Amsco in 1937 as eastern sales manager in the New York office. Mr. Terbell was appointed a vice-president of the Steel division in 1940.

◆

FITZGIBBONS BOILER COMPANY.—The Fitzgibbons Boiler Company is converting its plant at Oswego, N. Y., to the production of boilers for locomotives.

Obituary

WALTER H. HINSCH, chief engineer of the Dearborn Chemical Company, Chicago, who was granted a leave of absence on January 1, 1942, to serve as lieutenant colonel of the 267th Field Artillery, was killed at Camp Van Dorn, Miss., on November 15 during maneuvers with live ammunition.

◆

WILLIAM E. HEDGCOCK, vice-president in charge of sales of the American Car and Foundry Company and former purchasing agent for that company, who died October 26 in New York, as announced in the November issue, was 76 years of age. He had been associated with the American Car and Foundry Company and its predecessor companies for more than 60 years. He was born in Jeffersonville, Ind., and, at the age of 14, joined the Ohio Falls Car Manufacturing Company where he was employed in various capacities and finally as supply agent. When that company became part of the American Car and Foundry group in 1899 Mr. Hedgcock was transferred to the purchasing department at St. Louis, Mo. He subsequently became purchasing agent at St. Louis and in 1918 was transferred to New York. He was elected assistant vice-president in charge of sales in 1923 and was placed in charge of the eastern sales district in 1925. He became acting head of the



William E. Hedgcock

sales department in 1940 and was appointed vice-president in charge of sales in January, 1941. Mr. Hedgcock was vice-president of the American Railway Car Institute and a director of American Car and Foundry Securities Corp. and the American Car and Foundry Export Co.

Personal Mention

General

GUY M. GRAY, superintendent of motive power of the Bessemer & Lake Erie with headquarters at Pittsburgh, Pa., has resigned from this position after more than 47 years of service with the company.

EDWIN F. RICHARDSON, assistant superintendent of motive power of the Bessemer & Lake Erie has been appointed superintendent of motive power, with headquarters at Pittsburgh, Pa.

ALAN BEARDSHAW, who has been appointed general superintendent of motive power and car equipment of the Western Region of the Canadian National at Winnipeg, Man., as announced in the October issue, was born in Lewisham, England, on June 27, 1891, and entered railway service on the Grand Trunk (now part of Canadian National) at Toronto in November, 1912, later being transferred successively to Sarnia, Ont., Regina, Sask., Mimico, Ont., and Richmond, Que., where in 1915, he became locomotive foreman. He served with the Royal Navy from 1916 to 1919 and then returned to the C. N. R. as assistant foreman at Turcot, Que., becoming locomotive foreman shortly afterward. In January, 1935, Mr. Beardshaw was appointed superintendent of motive power and car equipment at Toronto.

F. O. YOUNG, chief draftsman of the Northern Pacific at St. Paul, Minn., has been promoted to mechanical engineer, with headquarters at St. Paul.

LEWIS S. BILLAU, who has been appointed electrical engineer of the Baltimore & Ohio, with headquarters at Baltimore, Md., as noted in the November issue, was born in Cedar Rapids, Iowa, in 1884. He attended the University of Minnesota where he received his degree in electrical engineering in 1905. His first employment was in the test department of the General Electric Company at Schenectady, N. Y., where he specialized in the field of heavy electric traction. Mr. Billau entered the employ of the B. & O. in 1908 as an inspector in the electrical department; became assistant engineer in 1909; chief draftsman in 1910, and assistant electrical engineer in March, 1914. Mr. Billau holds a life membership in the American Institute of Electrical Engineers. He is also a member of the committee of direction, electrical section, Mechanical Division and a member of the Electrical Section, Engineering Division, Association of American Railroads.



Lewis S. Billau

J. W. HAWTHORNE, has been appointed assistant superintendent of motive power of the Central of Georgia, with headquarters at Savannah, Ga. Mr. Hawthorne, who was previously in the employ of the New York Air Brake Company, is a graduate of Purdue University where he specialized in locomotive and car design, receiving the degree of B.S. M.E. in 1933. From July, 1933, until July, 1936, he was employed at the Watertown, N. Y., plant of the New York Air Brake Company. During the latter year he was transferred to Cleveland, Ohio, as service representative. From January, 1940, until July, 1940, he was on leave and was air-brake instructor on the Chesapeake & Ohio at Richmond, Va.

WILLIAM MOORE, who has been appointed superintendent of motive power of the Erie, with headquarters at Cleveland, Ohio, as noted in the November issue, was born at Hornell, N. Y., and attended Park, Institute, Pittsburgh, Pa. In 1906 he became a foreman of the Erie at Meadville, Pa., and three years later enginehouse foreman, with headquarters at Carbondale, Pa. From 1915



William Moore

to 1917 Mr. Moore served as general foreman at Marion, Ohio, and Meadville, and in 1918 he was promoted to the position of master mechanic, with headquarters at Kent, Ohio. In 1921 he was transferred to Susquehanna, Pa., and in 1938 to Buffalo, N. Y. In 1941 he was appointed assistant to the superintendent of motive power, with headquarters at Cleveland. Mr. Moore is a past president of the Central Railway Club, Buffalo.

WILLIAM A. CARLSON, western district manager of the Erie at Meadville, Pa., has been appointed assistant superintendent of motive power with headquarters at Cleveland, Ohio. Mr. Carlson was born at Chi-



William A. Carlson

cago on April 27, 1890, and entered railway service in June, 1906, as a machinist helper of the New York, Chicago & St. Louis (Nickel Plate), at Chicago, subsequently serving as a machinist at Fort Wayne, Ind. In 1913 he went with the Chicago & Alton (now the Alton) as a machinist at Chicago, and one year later he went with the Chicago, Rock Island & Pacific, in the same capacity and with the same headquarters. In July, 1915, Mr. Carlson returned to the Nickel Plate as a machinist and later served as roundhouse foreman and general foreman at Fort Wayne. In 1928 he became general master mechanic of the Erie at Hornell, N. Y., and in 1929 he was advanced to Western district master mechanic, with headquarters at Meadville, Pa., holding that position until his new appointment.

EDWIN F. RICHARDSON, assistant superintendent of motive power of the Bessemer & Lake Erie at Greenville, Pa., has been appointed superintendent of motive power, with headquarters at Greenville. Mr. Richardson was born at Shenango, Pa., on Sep-



Edwin F. Richardson

tember 13, 1880. He entered railroad service on June 1, 1899, as a special apprentice of the Bessemer & Lake Erie. He then served successively as air-brake inspector and air-brake instructor until 1918, when he became assistant to the engineer motive power. Mr. Richardson was appointed assistant engineer motive power in November, 1936, and assistant superintendent motive power in May, 1939.

W. E. BARNES, who has retired as general superintendent of motive power and car equipment of the Atlantic Region of the Canadian National as noted in the October issue, was born on July 24, 1877, at Shediac, Westmoreland county, N. B. He entered railroad service on April 20, 1899, as an apprentice draftsman of the Intercolonial (now Canadian National), later serving a special machinist apprenticeship until 1906, when he became a machinist of the Canadian National. In April, 1910, he became locomotive and enginehouse inspector; in January, 1911, acting master mechanic; on September 1, 1912, master mechanic and in February, 1918, general master mechanic. Mr. Barnes was appointed superintendent of motive power in March, 1923; general superintendent of motive power on January 1, 1928, and general superintendent motive power and car equipment at Moncton, N. B., on August 1, 1932.

T. F. POWERS, who has been appointed chief mechanical officer of the Chicago & North Western as noted in November, was born at Winona, Minn., on October 2, 1882, and entered railway service on May 1, 1899, as a water boy, bridge and building department of the North Western at Winona. Two years later he began serving his apprenticeship as a mechanic in the locomotive shops at Winona and in 1906 became a mechanic. In 1907 Mr.



Thomas F. Powers

Powers became a mechanic in the employ of the Duluth, South Shore & Atlantic at Marquette, Mich., and in July, 1908, he returned to the North Western, being promoted to the position of foreman at Chadron, Neb., one year later. In 1926 he was appointed assistant superintendent of motive power and machinery, Northern district, and in December, 1941, superintendent of motive power, Northern district.

R. W. KELLER, who has been appointed electrical engineer of the Central of New Jersey, with headquarters at Jersey City, N. J., as noted in the November issue, entered railroad service in 1913 as an elec-

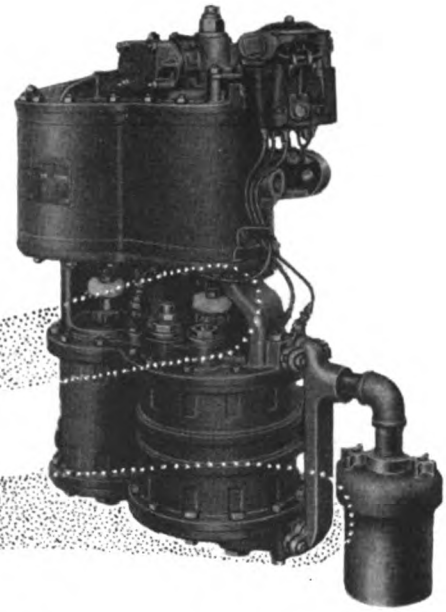


R. W. Keller

trician in the employ of the Central of New Jersey, and was assigned to a construction gang on wiring stations and engine terminals, and construction work in general. In 1916 he was promoted to fore-

(Continued on next left-hand page)

High Standards Maintained for Compressor Replacement Parts







Our "know-how" of air compressor replacement parts has a background of three generations . . . knowing the best available material for the job . . . possessing the craftsmanship to do it well.

There is no let-down in standards . . . the same high quality built into the original is maintained in the replacement, a policy that extends compressor service life with top efficiency.

It is a small part of the proud story of war time railroading — the amazing ability of equipment to "take it" far above and beyond the normal call.





WESTINGHOUSE AIR BRAKE CO.

WILMERDING, PENNSYLVANIA

man with headquarters at Jersey City, handling maintenance and construction in that area. In 1926 he became general foreman, handling locomotive lighting, train control, car lighting, and air conditioning as well as maintenance and construction. He was appointed supervisor in charge of electrical matters in 1935.

JOHN R. FINNERTY, road foreman of engines of the Scranton division, Delaware, Lackawanna & Western, has been appointed rules examiner with headquarters at Scranton, Pa.

WALTER U. APPLETON, vice-president of the Atlantic region of the Canadian National at Moncton, N. B., has retired. Mr. Appleton was born at Moncton on January 29, 1878, entering the service of the Intercolonial (now Canadian National) as a junior clerk in October, 1890. Until October, 1913, he served successively as machinist apprentice, machinist, chief clerk, assistant to the superintendent of motive power and as general master mechanic. When the



Walter U. Appleton

Intercolonial became part of the Canadian Government Railways, Mr. Appleton, in February, 1918, was appointed superintendent of motive power, and in December of the same year mechanical superintendent. With the amalgamation of the Canadian Government Railways and the Canadian National System, Mr. Appleton was appointed general superintendent of rolling stock in 1920. In 1923 he became general superintendent of the Atlantic region; general manager of the Atlantic region in 1924, and in 1935 became also vice-president of that region, with headquarters at Moncton.

N. R. CRUMP, who has been appointed general superintendent of the Ontario district of the Canadian Pacific, with headquarters at Montreal, Que., as was noted in the November issue, was born on July 30, 1904, at Revelstoke, B. C., and received his B.S. and M.E. degrees from Purdue University, Lafayette, Ind. He entered railroad service in 1920 as a machinist apprentice of the Canadian Pacific at Field, B. C., transferring to the Weston shops at Winnipeg, Man., in 1922. He then attended Purdue from 1925 to 1929, after which he returned to Winnipeg as a machinist. In 1930 Mr. Crump became night foreman at Sutherland, Sask., subsequently becoming shop foreman, first at Lethbridge, Alta., and then at Calgary, Alta. He also



N. R. Crump

served successively as locomotive foreman at Wilkie, Sask., night foreman at Moose Jaw, Sask., and division master mechanic at Moose Jaw, and in 1936 was transferred to Regina, Sask. He was appointed chief mechanical draftsman, Western lines, at Winnipeg in 1939, assistant superintendent of motive power for Western Canada in 1940, and assistant to the vice-president in 1942.

ALBERT E. COLEMAN, who has been appointed assistant superintendent of motive power of the Canadian National, Montreal terminals, Que., as announced in the November issue, was born and educated at Montreal, where he entered railway service. In 1919 he entered the service of the Grand Trunk (now part of Canadian National), as an electrician at Turcot, Que. He later



A. E. Coleman

worked in the Montreal motive power and car shops, and was transferred to Toronto, Ont., in 1923, becoming supervisor of unit cars in 1925. He was appointed electrical superintendent of the St. Clair Tunnel in 1940.

JOHN KYLE, who has retired as general superintendent of motive power and car equipment of the Western Region of the Canadian National as noted in the October issue, was born in Toronto on April 11, 1878, and entered railway service as a mechanical apprentice on the Grand Trunk (now part of the Canadian National) in 1893. In 1899 he went with the Canadian Pacific at Winnipeg and in 1903 was appointed general foreman of the Canadian Northern (now part of the Canadian National), later becoming assistant master mechanic. In 1907 he was transferred to Edmonton, Alta., and in 1912 was promoted to the position of master mechanic at Edmonton. Mr. Kyle was appointed superintendent of motive power and car equipment at Edmonton in 1923 and general superintendent of motive power and car equipment of the Western region at Winnipeg in 1932.

J. E. GOODWIN, who has been appointed assistant chief mechanical officer, system, of the Chicago & North Western, with headquarters at Chicago, as noted in November, entered railway service as a machinist apprentice in the employ of the Atchison, Topeka & Santa Fe in 1917, and after completing his apprenticeship, resigned to enter college, studying engineering at Wake Forest College and the University of Chicago. He reentered railroad service in 1925 as a machinist of the Missouri Pacific at Hoisington, Kan.,

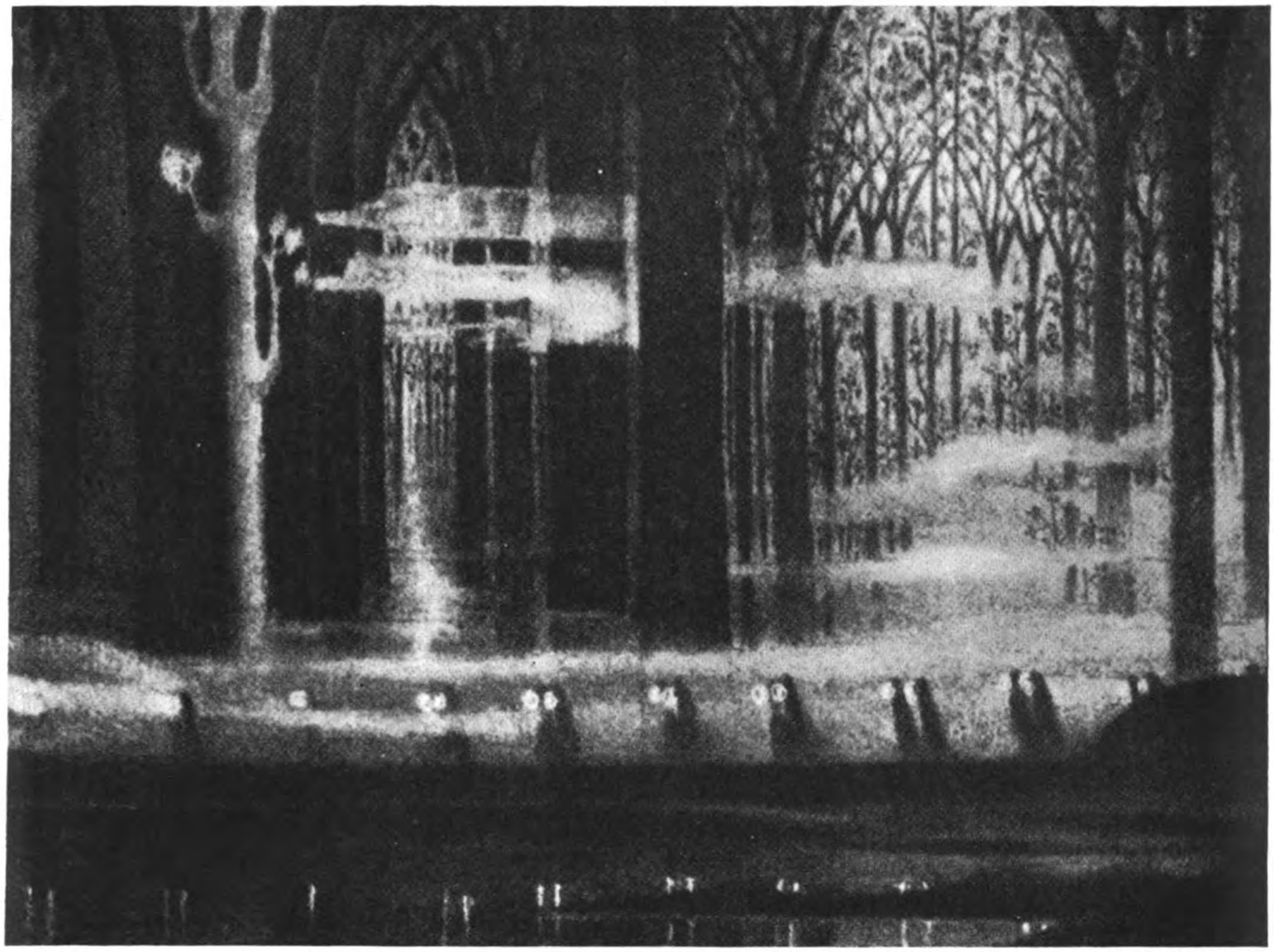


J. E. Goodwin

and during the following year was promoted to the position of enginehouse foreman. In 1929 he was appointed foreman of the backshop at Little Rock, Ark., later serving as acting superintendent for a short time and then as general foreman. On January 28, 1941 he was appointed master mechanic of the Palestine and San Antonio division of the International-Great Northern (part of the Missouri Pacific system), with headquarters at San Antonio, Tex., and on January 1, 1942, became mechanical superintendent of the Southern district. Mr. Goodwin is president of the Locomotive Maintenance Officers' Association.

BLAIR L. THOMPSON, who has been appointed mechanical inspector of the Canadian National with headquarters at Montreal, Que., as noted in the October issue, was born on July 20, 1906, at Moncton,

(Continued on next left-hand page)



©Walt Disney Productions

What's the word you think most of at Christmas?

THERE'S one word men of good will everywhere associate with Christmas.

That word is *"Peace. Peace on earth"*...

There can be no peace this Christmas. Not one of us would want the only kind of peace there could be, an inconclusive peace.

But we do want the right kind of peace as soon as possible. And this Christmas we can help hasten the coming of that wonderful day, by making War Bonds our chief gift.

Every Bond you buy brightens the chances of a better world than man has ever known.

How, then, could you possibly give a better present than Bonds, Bonds, Bonds? Give them to each member of the family. Give them to your friends. Give them to *everybody—the greatest gift of all!*

Alco Give War Bonds for Christmas

AMERICAN LOCOMOTIVE COMPANY

This advertisement prepared under the auspices of the U. S. Treasury Department and the War Advertising Council.

N. B. He attended Moncton City schools and studied shop practice and mechanical engineering subjects with the International Correspondence Schools. He entered the employ of the Canadian National on November 1, 1923, as a telegraph messenger. On March 23, 1924, he became a machin-



B. L. Thompson

ist apprentice; on March 27, 1929, a locomotive draftsman; on June 15, 1935, material inspector; on January 1, 1938, mechanical inspector, Atlantic Region, and on August 16, 1943, mechanical inspector for the entire system. For several months during the period from January 1, 1938, to August 16, 1943, he was acting assistant locomotive foreman and locomotive foreman at Sydney, N. S., and Moncton.

O. J. Protz, superintendent of locomotive and car shops of the Chicago & North Western, has been appointed superintendent of motive power, Northern district, with headquarters as before at Chicago. Mr. Protz was born at Winona, Minn., on February 23, 1886, and entered railway service on April 9, 1903, as a fitter helper in the pipe department of the North Western at Winona. He served as a machinist apprentice and machinist, with the same headquar-



Otto J. Protz

ters, and in February, 1914, became engine foreman at Wyeville, Wis. In 1917 Mr. Protz was transferred to Huron, S. D., and three years later he was promoted to the position of general foreman, with headquarters at Belle Plaine, Iowa. From 1920 to 1927 he served as general foreman at Missouri Valley, Iowa, and Chicago. In April, 1928, he became master mechanic with headquarters at Winona, being transferred to Escanada, Mich., in 1929, and to Clinton, Iowa, in 1931. On October 1, 1939, Mr. Protz was appointed superintendent of locomotive and car shops at Chicago.

Master Mechanics and Road Foremen

Willard E. Brautigam, who has been appointed division master mechanic of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Deer Lodge, Mont., as noted in the October issue, was born on September 21, 1892, in Laramie, Wyo. He attended Tacoma High School and from 1913 to 1915 was both a student at the University of Washington and an electrician in the employ of the Milwaukee at Tacoma, Wash., and Seattle. He was electric locomotive electrician at Deer Lodge



W. E. Brautigam

and Avery, Idaho, from 1915 to 1920; electrical instructor at Tacoma, 1920 to 1923; night enginehouse foreman at Deer Lodge, 1923 to 1925; enginehouse foreman at Deer Lodge from 1925 to 1926; electrical inspector from Tacoma to Harlotown, Mont., 1926 to 1928, and enginehouse foreman at Deer Lodge 1928 to 1943.

Purchasing and Stores

Howard Crouse, general storekeeper of the Texas & Pacific at Marshall, Tex., has been appointed purchasing agent, with headquarters at Dallas, Tex.

Obituary

Arthur B. Childs, chief mechanical engineer of the Northern Pacific, with headquarters at St. Paul, Minn., died in Minneapolis, Minn., on November 4.

F. S. McClung, purchasing agent of the Texas & Pacific, with headquarters at Dallas, Tex., died on October 20, after an illness of three months.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

Tools for Electrical Maintenance.—Ideal Commutator Dresser Company, Sycamore, Ill. Eighty-eight page, 8½-in. by 11 in. catalog designated as Handbook No. 143 and bearing the title, "Speed-Up Tools and Equipment for Maintenance, Production and Construction." Includes illustrated descriptions of commutator reconditioning tools, coil winders, wiring tools, air cleaners, solder and solderless connection, storage battery type flashlights, tachometers, magnetic chucks and variable-speed drives.

◆

Kennametal Carbide Tools, Blanks and Specialties.—Kennametal, Inc., 1000 Lloyd avenue, Latrobe, Pa. Catalog 43C, in three sections, illustrated—Section I, Standard tools; Section II, typical tools; Section III, general information on the origin and characteristics of Kennametal, how to select the proper grade, how to specify and order tools and blanks, etc.

◆

"Lengthened Shadows." — Elwell-Parker Electric Company, Cleveland, Ohio. Fiftieth anniversary book. Reviews company's development since 1893 and, to a considerable extent, that of the industrial truck industry after 1906, the year that Elwell-Parker furnished motors for the first crude baggage-handler for the Pennsylvania. Story reaches back also to the birth in 1843 of Thomas Parker, one of the founders of the electrical industry in Great Britain. The old firm of Elwell-Parker Ltd., manufacturers of motors and dynamos in Wolverhampton, England, in 1893 licensed a separate company to build them in America, but soon after the turn of the century sold its interest in the Elwell-Parker Electric Company, Cleveland.

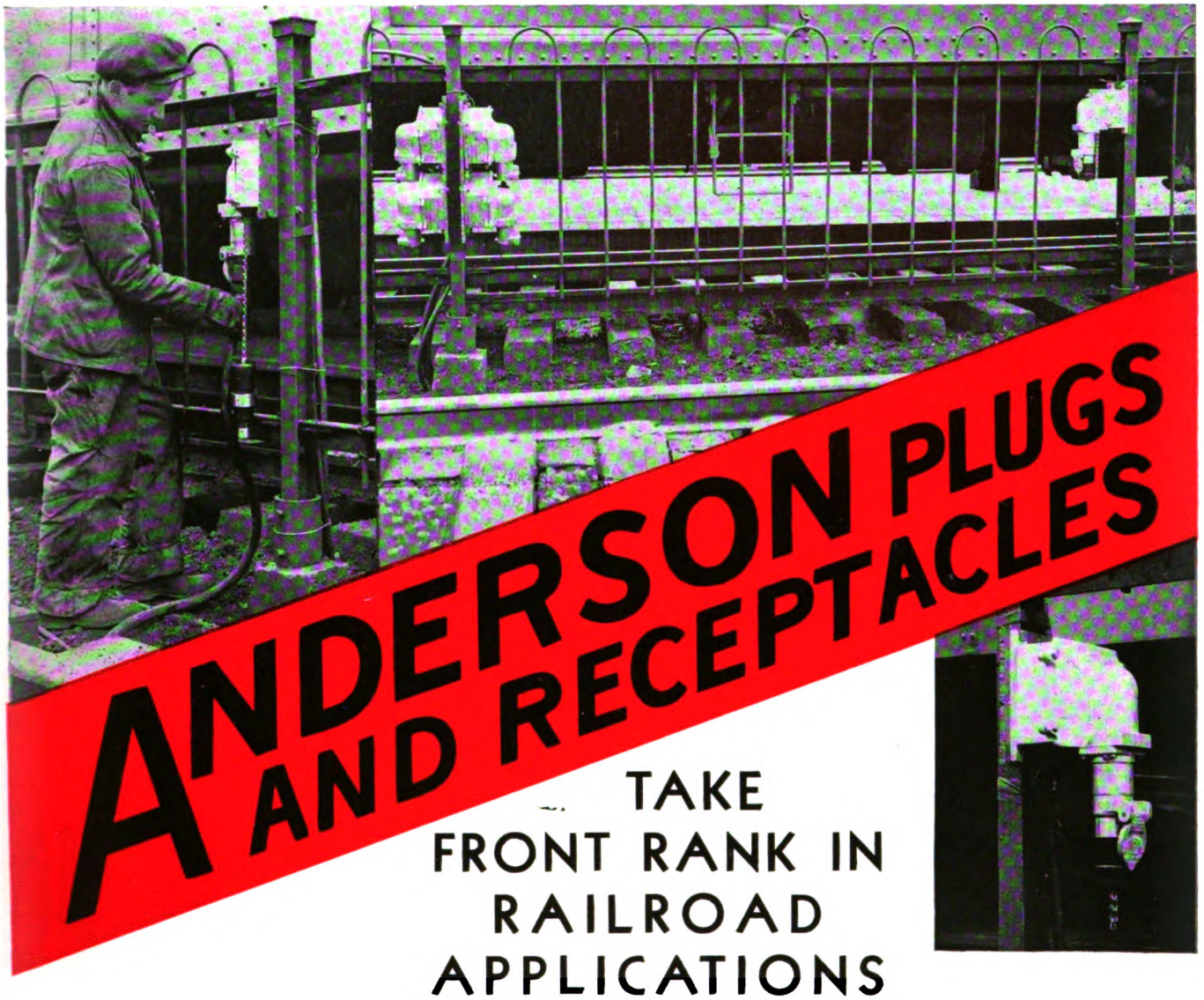
◆

National Machinery Company.—The cold heading and bolt and nut machinery business of the *E. J. Manville Machine Company, Inc.*, Waterbury, Conn., including the corporate name and goodwill, has been acquired by the National Machinery Company, Tiffin, Ohio. After January 1 this new acquisition will be identified as the E. J. Manville Machine Company, Division of the National Machinery Company, Tiffin.

◆

Pressure-Treated Wood. — Koppers Company, Wood Preserving Division, Pittsburgh, Pa. "Economical and Permanent Construction with Pressure-Treated Wood." One of the main sections discusses the uses of pressure-treated lumber in the operation of railroads. A special section explains several processes by which lumber is treated to protect it against decay, marine borers, acids, fire and terminals. Sixteen railroad installations illustrated and recommended uses of pressure-treated lumber in the railroad field listed.

WE SAY IT AGAIN



ANDERSON PLUGS AND RECEPTACLES

TAKE FRONT RANK IN RAILROAD APPLICATIONS



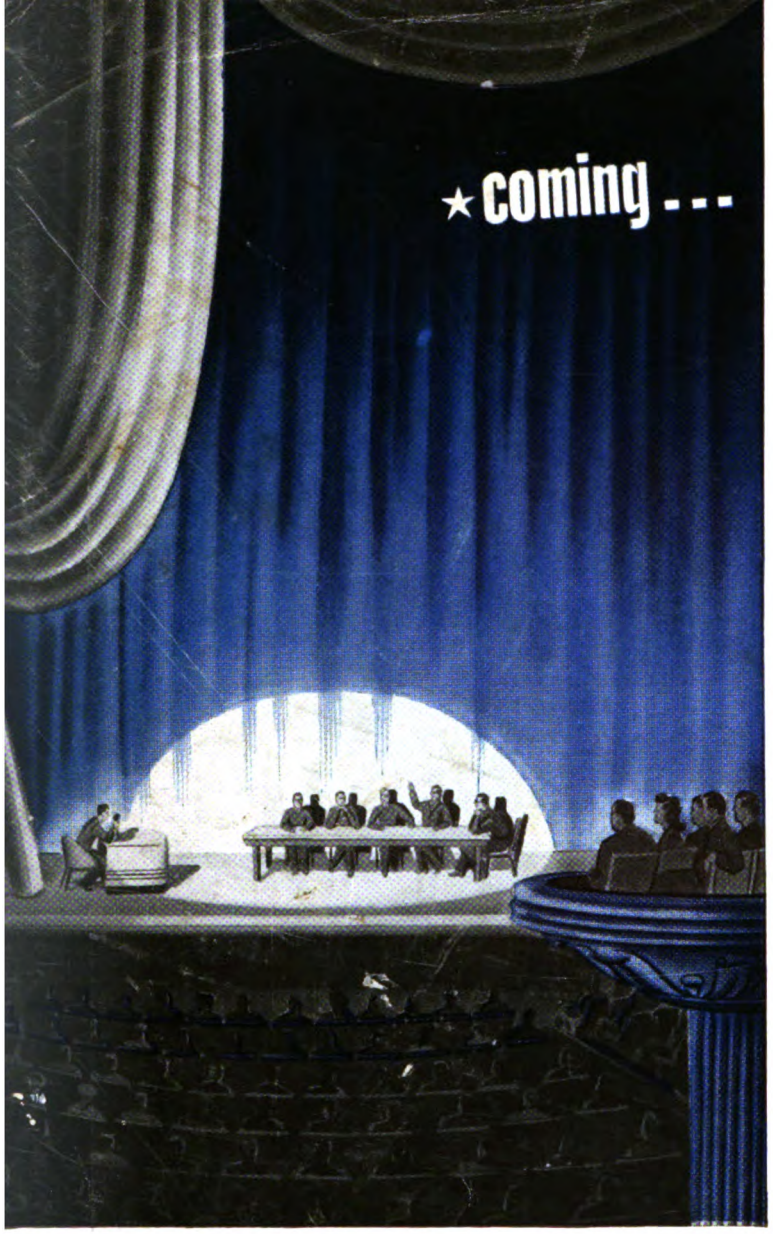
WE emphasize the universal employment of Anderson Plugs and Receptacles because of its significance. Since the days when electricity was first put to use in railroad shops, for lighting and for subsequent applications, our products have kept step with the industry.

Anderson equipment is manufactured to the most rigid specifications for use in connection with Air Conditioning, Battery Charging, Marker Lights, Yard Receptacles, Platform Receptacles, Portable Tools, Telephones, Switchboards, Welding Couplers, Watertight Plugs and Receptacles, Turntables, Industrial Trucks.

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the biggest quiz program of a

It doesn't have a $64 question. It has millions of them. It is an international program that must originate in the minds of men — American production men. It should be in the planning stage right now. It has to be ready to go with Victory . . . when plants now three-shifting for war, turn to "peace-work". When world markets are but sixty hours from your shipping depot. When your peace-work product must meet and beat competition. Too late then to plan for better, cheaper, faster production. The time to face the future is *now*. The profitable time to retool is *now*. If it's lathes — turn to LeBlond for better turning equipment.

THE R.K. LeBLOND MACHINE TOOL CO., CINCINNATI, 8

NEW YORK 13, 103 Lafayette St. CAnal 6-5281

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time to retool

Turn to LeBlond for Turning Equipment

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES



Check-Clip-Mail

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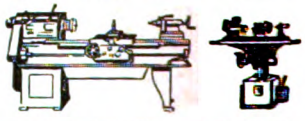
- ☐ HEAVY DUTY GEARED HEAD ENGINE LATHES
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YOUR NAME _____ TITLE _____

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BUY A "BLOCK-BUSTER" TODAY!



HD Engine Lathes—Nine sizes ranging from 12" to 50" swings. For versatility in turning.

Automatic Lathes—12" & 16" Mechanical or Hydraulic power.

Super Regal Lathes—Six sizes, 13" to 24" Best for training.

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You Can Expedite
MAINTENANCE
on ***POWER*** and
ROLLING stock
by using

FAST-WORKING OAKITE MATERIALS

TODAY . . . when washing, cleaning, decarbonizing and descaling operations on railway equipment must be handled in greater volume at accelerated pace . . . Oakite materials are SPEEDING-UP MAINTENANCE for Mechanical Supervisors who must put power and rolling stock back into service QUICKLY with available manpower.

The trained men of our Railway Service Division are ready and anxious to do the same for YOU, particularly in connection with the work and operations listed in panel at right. Merely write, naming the jobs on which you want help . . . then leave the rest to us. Inquiries promptly answered.

OAKITE PRODUCTS, INC., WRIGLEY BUILDING, CHICAGO 11, ILL.

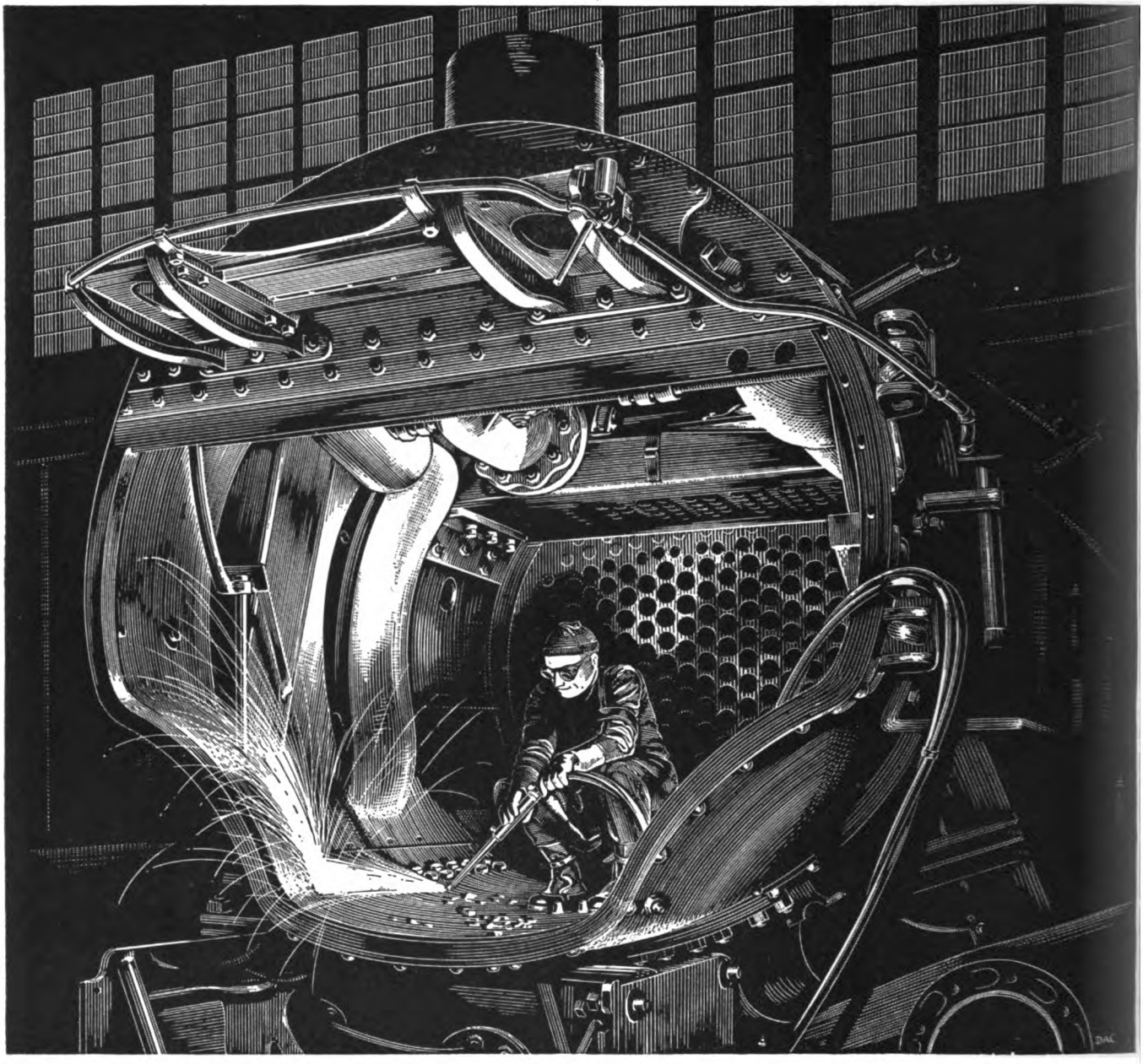
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OAKITE
RAILWAY SERVICE DIVISION



Rebirth of a Locomotive

IRON HORSES haul the major load of war production. They must keep rolling. Time out must be held to a minimum.

Above you see a "welder" engaged in washing out rivets to remove worn or damaged parts . . . an essential step to the rebirth of a locomotive. Railroads employ this modern tool for numerous other jobs . . . to shape-cut new metal parts quickly and accurately; to flame harden metal surfaces for resistance to wear; to build up worn rails; to flame clean bridges and other steel structures . . .

As with the railroads, so wherever man works with metal, the oxyacetylene flame and its companion, the electric arc, make possible faster and better ways of fabrication and upkeep.

Through constant improvement in the use of these modern "tools", Airco research is broadening their service to industry. Whether it be for maintenance or production, Air Reduction engineers will assist you in the application of the oxyacetylene flame and electric arc.

★ BUY UNITED STATES WAR BONDS ★

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SOLDIER SAVED BY ALERT CREW

Private Zacharias Bermudez opened his eyes. He was suffering terribly from his head to his heels.

Then he dimly realized that he was lying on hard ground. The gravel dug into his crumpled body; he couldn't move—just lay there and hurt.

By and by there came a roaring sound—and something rushed past him, screeching and smoking. Then he remembered. He had fallen off a troop train.

The pain in his head drove him nearly crazy. Where had he been going? Oh yes—eastward through Kansas. Funny how hard a cold wind could blow in Kansas. Still, he reflected, it was late in November.

More trains rushed past him. Two tumbleweeds, blown against him, nestled down by his head. So this was to be the finish of one soldier who wanted to fight the Germans!

Well, folks said freezing wasn't so painful. You just eased off into sleep, and that was the end of it. But it was rotten bad luck for a fellow who was willing to meet death in battle.

Private Zacharias Bermudez felt sleep stealing over him as another train hurtled past. That train—although Bermudez didn't know it—was the Missouri Pacific's No. 77, west bound on the Central Kansas division.

Engineer T. C. Tiller and Fireman H. C. Snodgrass were on Locomotive 2114, pulling that train. Both saw the object lying near the roadbed on the right-of-way.

"Might be just a tumbleweed," Snodgrass yelled to Tiller.

"I thought it looked like a soldier's uniform," Tiller yelled in reply.

Ten miles ahead was Leoti, where No. 77 wasn't scheduled to stop.

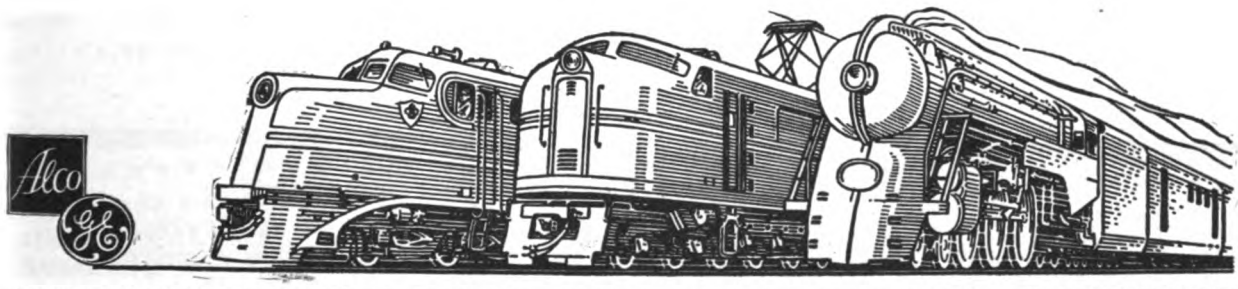
Taking no chances on losing a life, Snodgrass hurriedly scribbled a note, telling what the crewmen had seen, and tossed it off at Leoti station to Agent R. E. Padgett.

A troop train had passed through Leoti six hours before. Padgett dispatched a section crew to the scene.

Later, at the Scott City Hospital, examination revealed that Bermudez was suffering from a fractured skull and other injuries. On January 16, the Hospital released him, and he was sent to Camp Roberts, California—and to the military service he longed for.

But this soldier might have died, if Engineer Tiller and Fireman Snodgrass had not done some heads-up thinking and taken quick action.

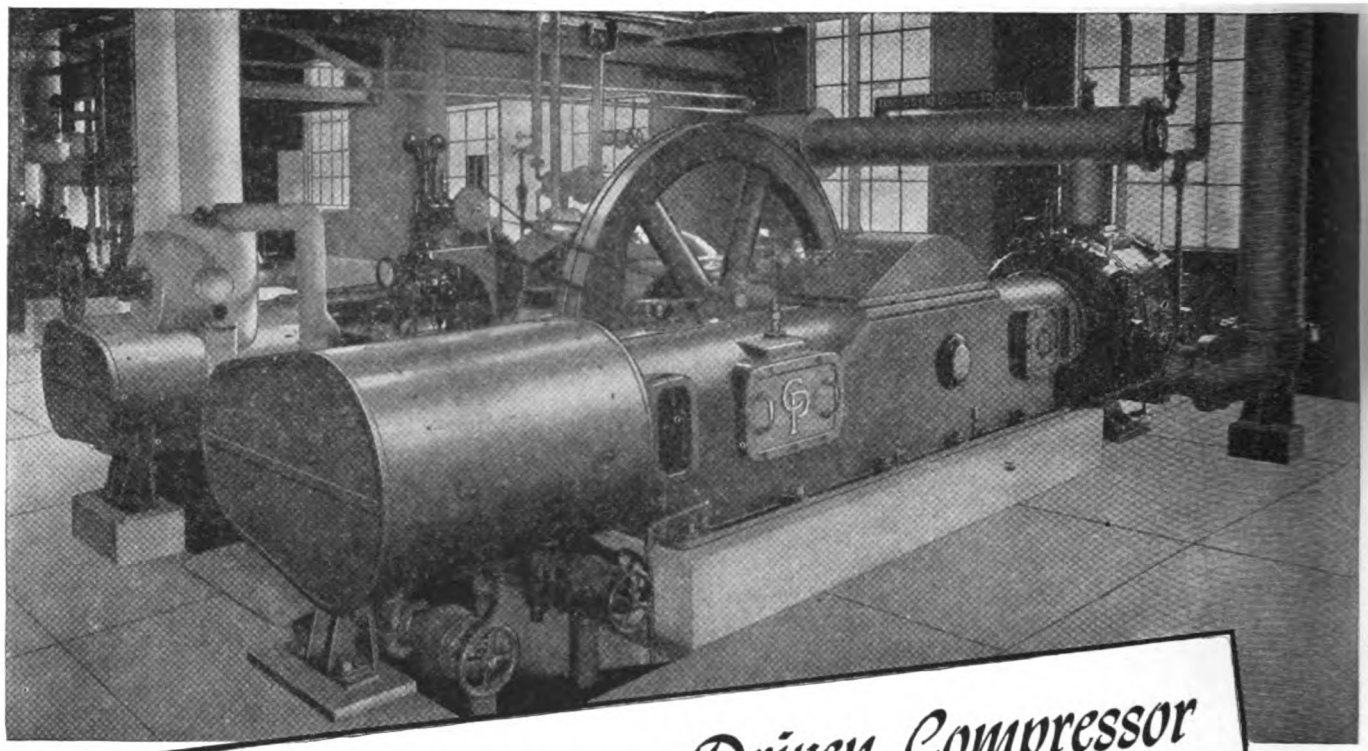
—The Trackwalker



AMERICAN LOCOMOTIVE • GENERAL ELECTRIC

Copr., 1943, American Locomotive Company and General Electric Company

113-47-9600



Another CP Steam-Driven Compressor GUARDS AGAINST POWER FAILURE

This CP Horizontal Duplex, Steam-Driven Compressor, installed in a war plant is safeguarding production against shutdown through power failure of the synchronous motor-driven CP Compressor installed with it.

CP Steam-Driven Compressors are playing their part in the war effort . . . protecting vital war plants against interruption of air supply due to power line failure . . . efficiently utilizing boiler capacity where it is more plentiful than electrical current . . . providing exhaust steam where needed for heating or process work.

CP Steam-Driven Horizontal Duplex, Two-Stage Compressors are ideal for large and medium-size plants. Capacities range from 400 to 6600 c.f.m., 100 to 125 pounds air pressure with steam cylinders available for a wide range of steam conditions. Other sizes in single and multi-stage design for lower and higher pressures. Write for literature.

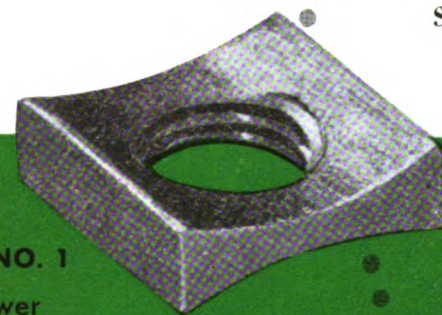
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PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL CP COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

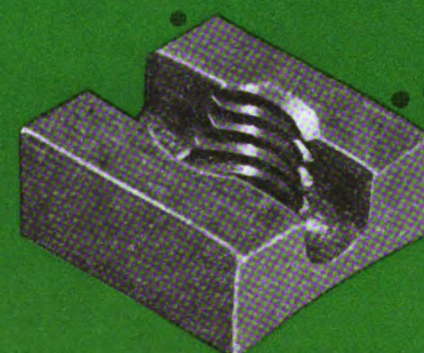
★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

stand-by, *n.* One that can be relied upon.

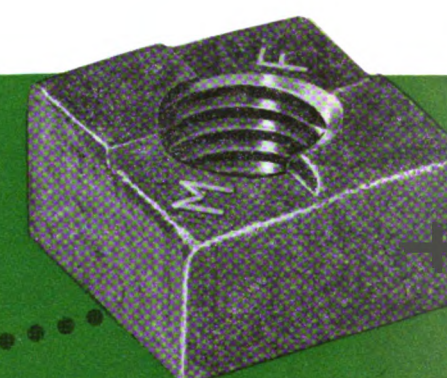
Lock Nuts, the first product of the MacLean-Fogg Lock Nut Co., are still the "old stand-by" of this organization ... dependable wherever used. "M-F" Lock Nuts have been known and used throughout the railway field for over 15 years. Today, more than ever, they are helping to keep rolling stock moving by maintaining sound fastenings.



M-F" LOCK NUT NO. 1
applies locking power back of a common nut.

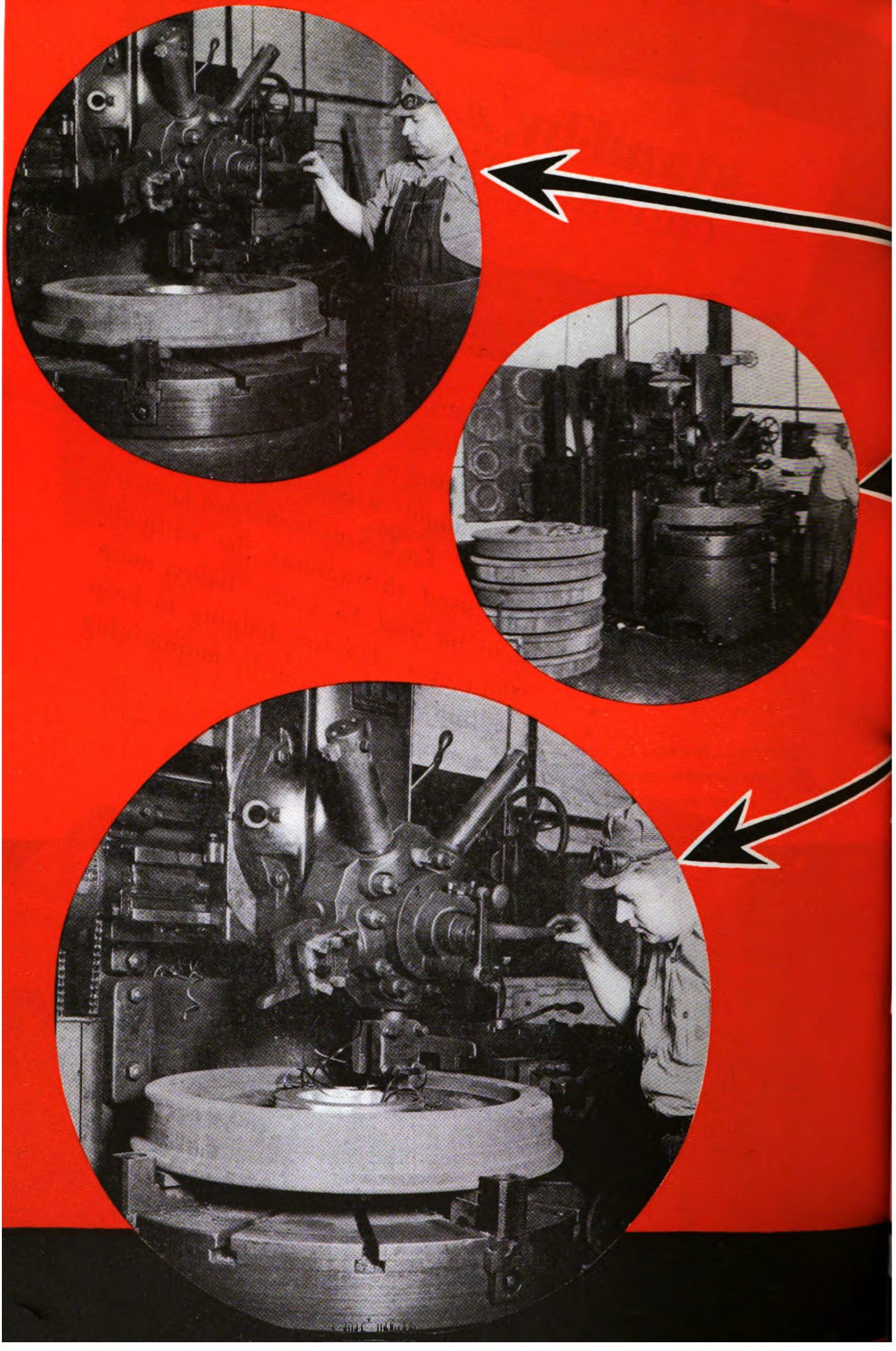


"M-F" SPEED NUT NO. 2
does the locking and holding job without any help.



"M-F" LOCK NUT NO. 3
a standard nut that locks by friction.

MAC LEAN-FOGG LOCK NUT COMPANY
2649 NO. KILDARE AVENUE CHICAGO, ILLINOIS
In Canada: The Holden Co., Ltd., Montreal



Streamlining the STREAMLINERS



HIGH speed trains demand high speed wheels—concentricity and accurate balance are very important factors in the elimination of wheel stresses.

Bullard Vertical Turret Lathes are helping the railroads to solve this problem. Illustrations on the opposite page show a standard 42" V.T.L. which is used exclusively for the boring and machining of wheels for Diesel Locomotives and streamlined trains.

Machining operations include boring for axle fit—facing and turning of the hubs and the plate. Tolerance limits are .001 plus and .003 minus.

The Vertical Turret Lathe has been a standard railroad shop tool for many years. Bullard engines are constantly working on new methods to reduce locomotive repair costs—they are always ready and willing to help you with your problems.

BULLARD R.R. SHOP UNITS

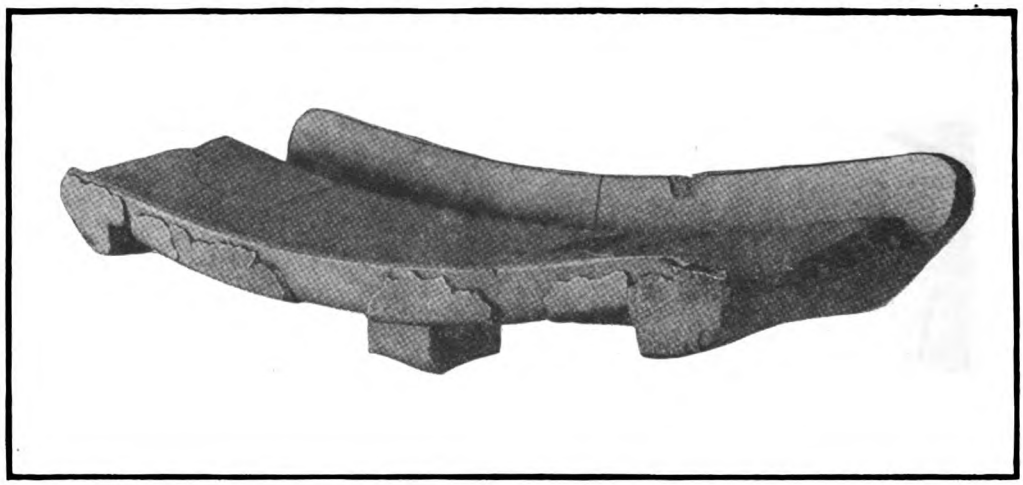
THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

Avoid Waste!

RECOGNIZE THE LIMITS OF WEAR FOR YOUR DRIVER BRAKE SHOES

Get full service from your driver brake shoes by wearing them evenly to a thickness of ½". Removing them from service *before* this limit has been reached will waste useful metal. Wearing them *beyond* this limit may injure wheels and brake heads. **Play safe and follow the prescribed limits of wear.**



● Evenly worn driver brake shoes are the result of good brake shoe practice. This shoe is evenly worn and has rendered maximum service.

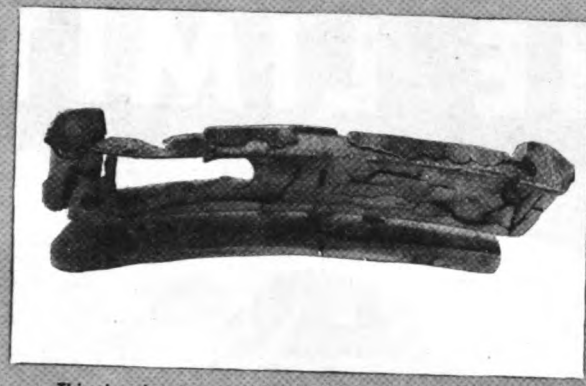
BRAKE SHOE AND CASTINGS DIVISION • 230 PARK AVENUE • NEW YORK, N. Y.

AMERICAN
Brake Shoe
COMPANY

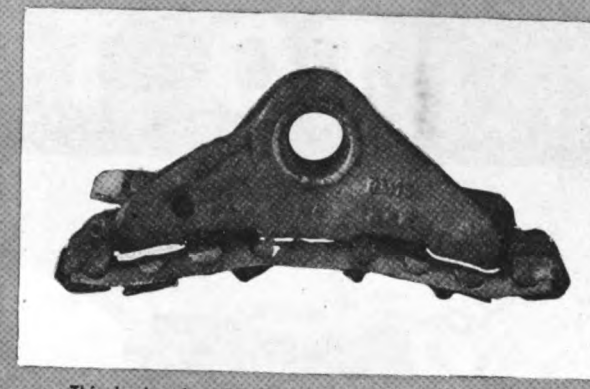
Enlarged and mounted reproductions of this advertisement and our previous advertisement featuring good car brake shoe practice are available upon request for posting in shops.

3419

THESE ARE THE PENALTIES OF POOR DRIVER BRAKE SHOE PRACTICE



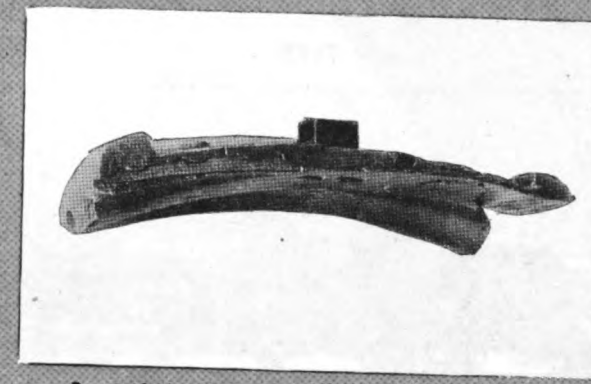
This shoe has been worn beyond the safe limit of wear and has caused injury to the brake head.



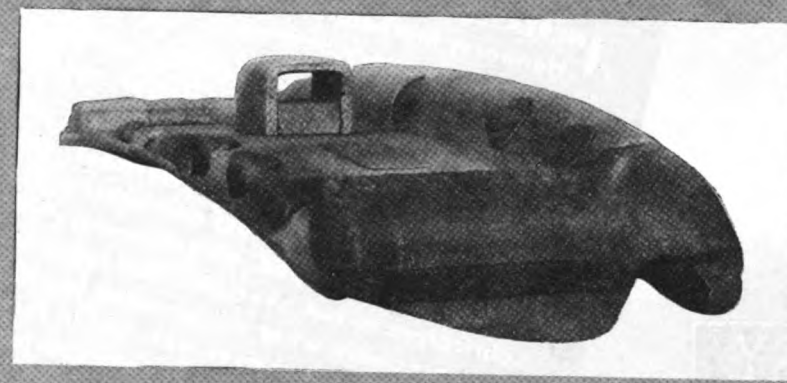
This brake shoe has been worn into the steel back. The steel back is badly distorted and has become welded to the brake head. It was necessary to scrap the brake head along with this shoe.



This shoe has been severely battered on top of the lug by the brake lever (probably due to a worn pin hole in the brake head). The lug has been so distorted that the key could be removed from the brake head only by cutting with a torch.



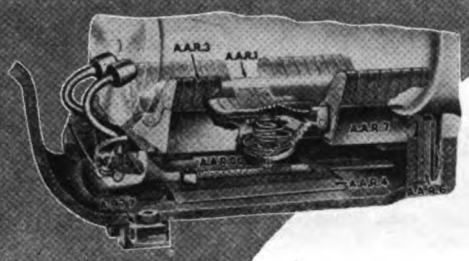
Due to faulty brake rigging, this driver shoe has become taper-worn. As a result, it had to be removed from service even though useful metal still remained on one end.



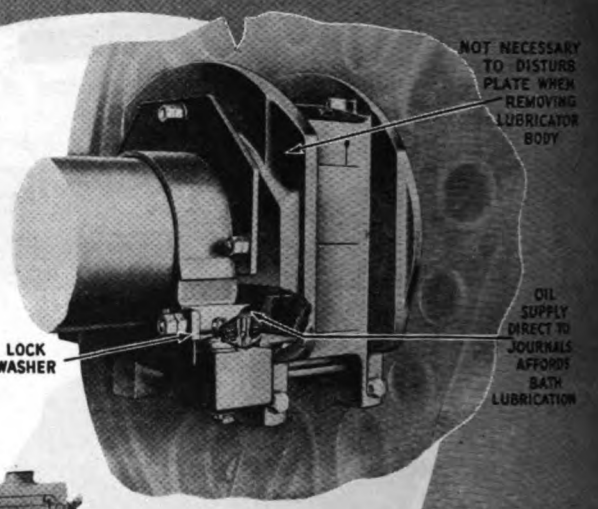
A wedge-worn driver shoe, probably caused by a hollow-worn tread or a cocked brake head on the driver wheel. Although this shoe has been worn to the condemning limit on its outside edge, there is nearly original thickness on the flange side. Brake head pins should be kept tight.

WITH THE HENNESSY *Mechanical Journal Lubricator*

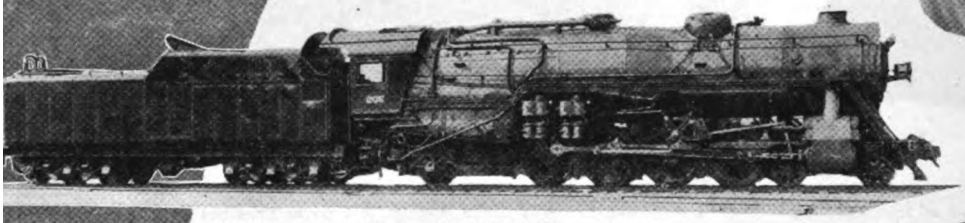
You Can Run Your Locomotives TO THE LIMIT!



A. A. R. TYPE
HENNESSY MECHANICAL JOURNAL LUBRICATOR



DRIVER TYPE
HENNESSY MECHANICAL JOURNAL LUBRICATOR



4-8-2 FREIGHT LOCOMOTIVE
264,000 LBS. WEIGHT ON DRIVERS

INCREASED availability of locomotives is a certainty when Hennessy Mechanical Journal Lubricators provide oil bath lubrication to every bearing.

Much shorter time is required for servicing, because of the ease of applying oil to the lubricator, resulting in decreased cost of maintenance.

The use of oil, the proper lubricant, conserves vital materials such as steel, brass and babbitt. It is not unusual for locomotives equipped with Hennessy Mechanical Journal Lubricators to run over 200,000 miles without any repairs or appreciable wear on journals, bearings and hub faces. No crown brass has ever worn out in service when provided with Hennessy Positive Oil Bath Lubrication.

HENNESSY LUBRICATOR

HENNESSY LUBRICATOR CO., Inc.

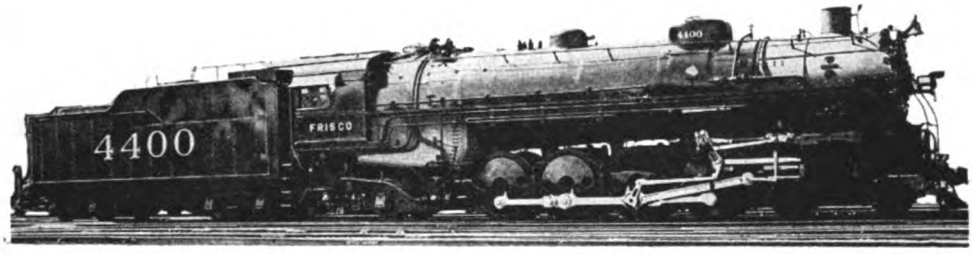
75 WEST STREET NEW YORK 6, N. Y.

MODERN LOCOMOTIVES EQUIPPED

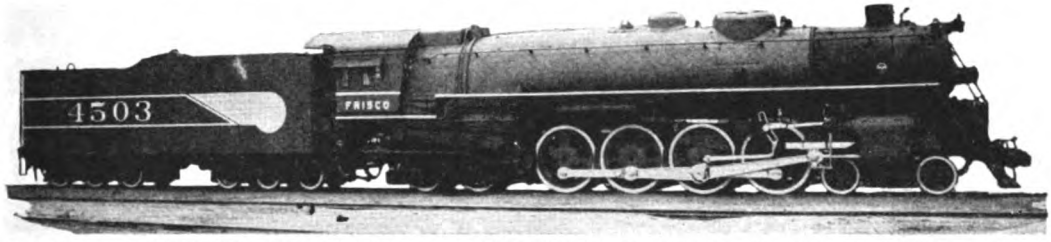
WITH HENNESSY MECHANICAL JOURNAL LUBRICATORS



4-6-6-4 FAST FREIGHT. DRIVING, TRAILER AND TENDER JOURNALS. 402,266 LBS. WEIGHT ON DRIVERS.



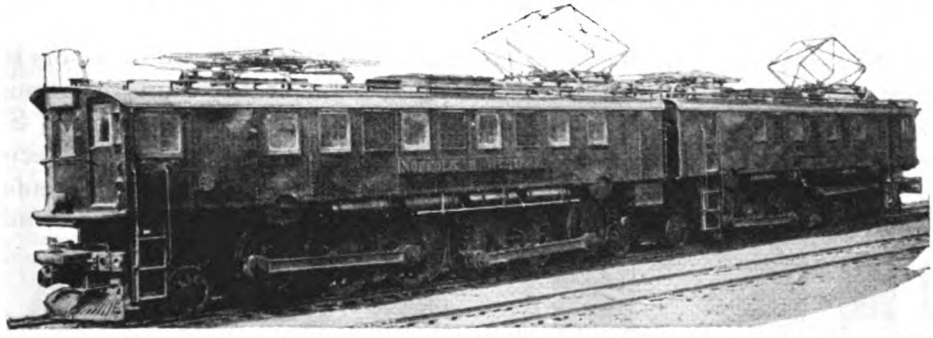
4-8-2 FAST FREIGHT. LEAD TRUCK, DRIVING AND TRAILER JOURNALS. 278,950 LBS. WEIGHT ON DRIVERS.



4-8-4 DUAL FAST PASSENGER-FREIGHT. ALL JOURNALS: LEAD TRUCK, DRIVING, TRAILER, TENDER. 280,000 LBS. WEIGHT ON DRIVERS



4-8-2 FAST FREIGHT. ALL JOURNALS: LEAD TRUCK, DRIVING, TRAILER, TENDER. 255,000 LBS. WEIGHT ON DRIVERS.



2-8-2+2-8-2 ELECTRIC HEAVY FREIGHT. ALL DRIVING JOURNALS. 596,000 LBS. WEIGHT ON DRIVERS.

HENNESSY LUBRICATOR CO., Inc.

75 WEST STREET NEW YORK 6, N. Y.



It must be apparent to any thinking man that the larger and more prominent the organization, the less it leaves the selection of vital production equipment to mere guesswork and opinion. The fact that the most prominent industrials in America. including those named above, have selected Sullivan Air Compressors is a judgment which *no* buyer who wants the utmost in dependability can afford to overlook. SULLIVAN MACHINERY COMPANY, Executive Offices: Michigan City, Indiana. *In Canada:* Canadian Sullivan Machinery Co., Ltd., Dundas, Ontario.

SULLIVAN

Air COMPRESSORS

They Bought SULLIVAN Air Compressors

PULLMAN-STANDARD CAR MANUFACTURING CO
Built by Pullman

SOLAR AIRCRAFT COMPANY

SERVEL GAS REFRIGERATOR

CRIBBEN AND SEXTON COMPANY

BENDIX AVIATION LTD

M-R-C Strom SRB GURNEY BALL BEARINGS

CHAMPION SPARK PLUGS

BELL Aircraft
Airacobras for victory

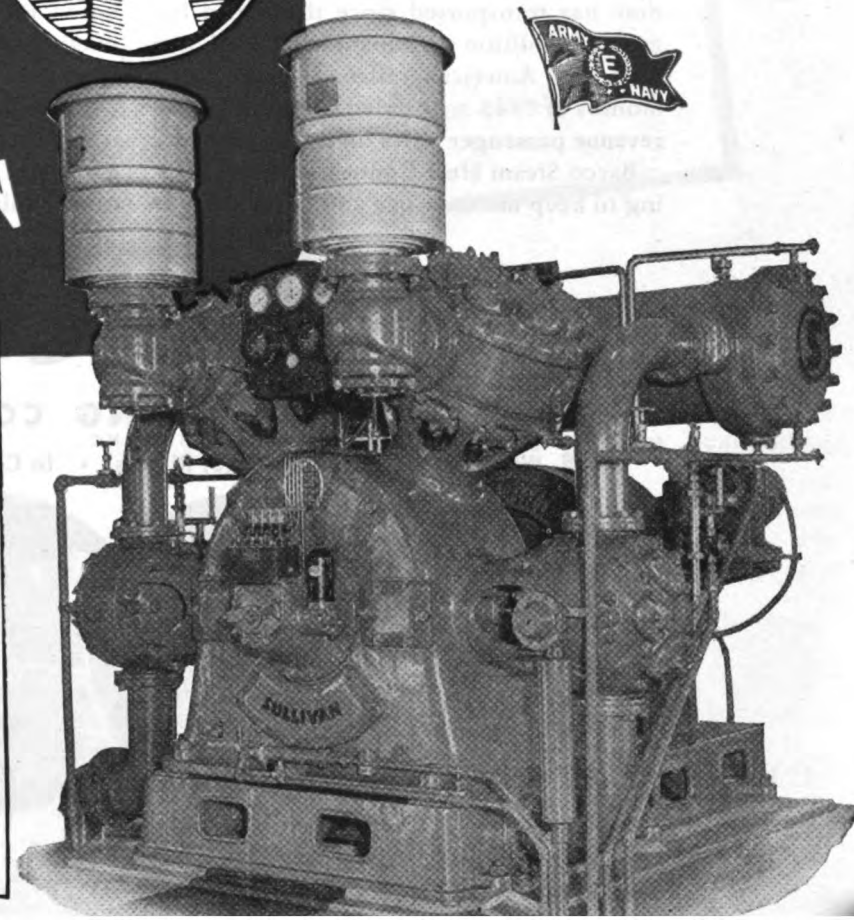
SAVAGE ARMS CORPORATION

FM

ARMY E NAVY

PORTLAND PENN-DIXIE CEMENT

WEIL-McLAIN

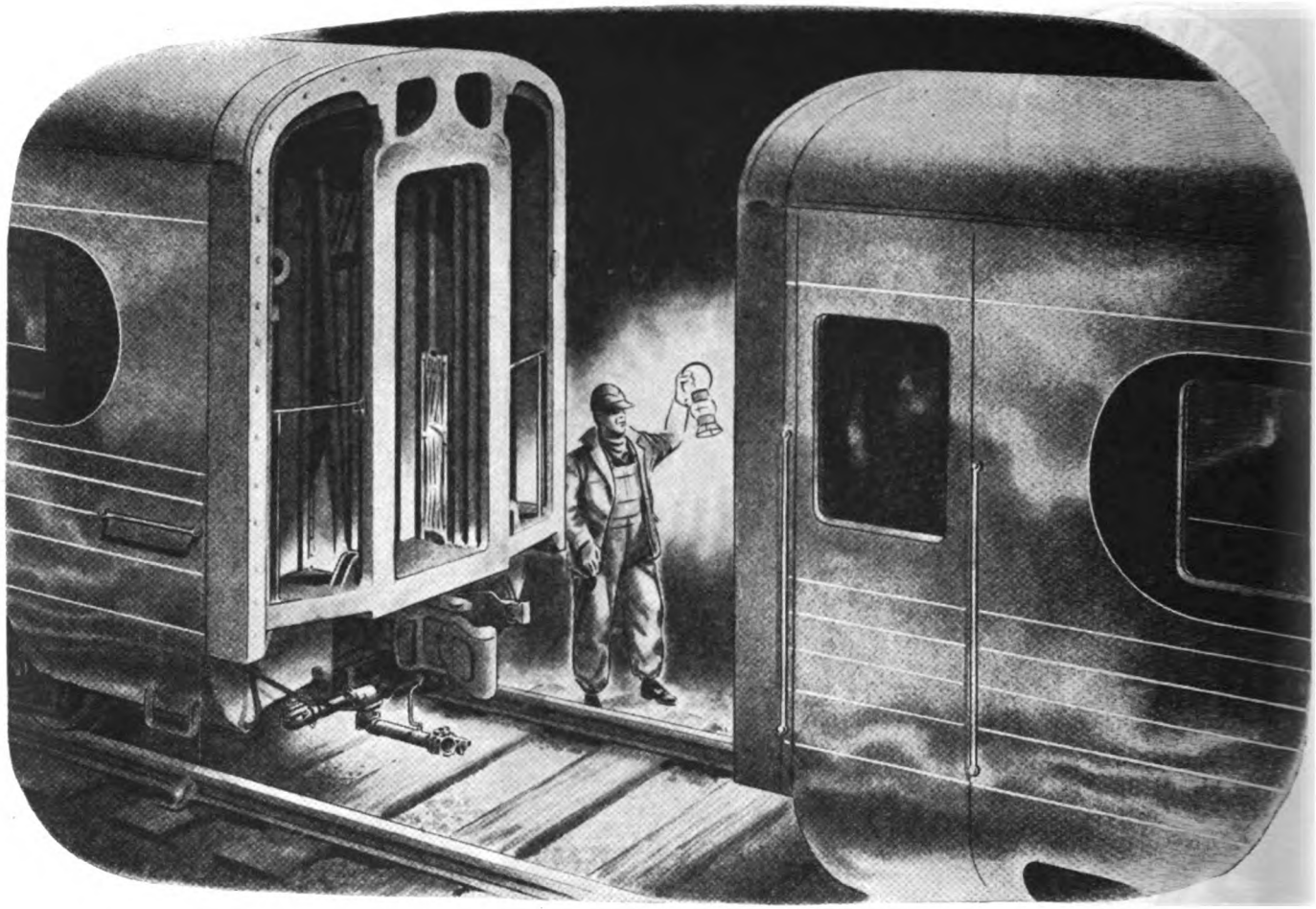


OFFICES

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PRODUCTS

HEAVY DUTY, SINGLE OR TWO STAGE STATIONARY AIR COMPRESSORS IN ANGLE, V-VERTICAL, VERTICAL OR HORIZONTAL TYPES IN SIZES FROM 1/4 TO 3000 H. P. ALSO A COMPLETE LINE OF PORTABLE COMPRESSORS



STEAM HEAT ON WHEELS

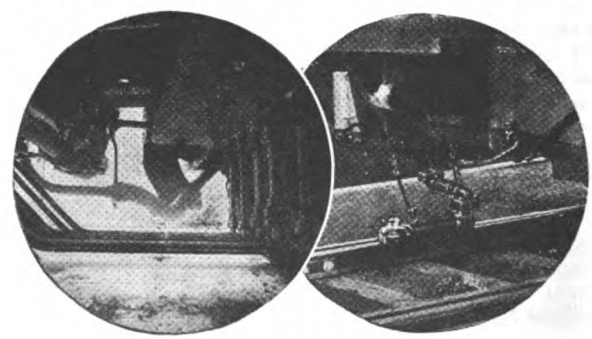
Today American railroads are carrying *more* traffic of every kind than *any* country at *any* time has transported since the world began. In addition to transporting vital war materials, American railroads . . . in seven months of 1943 . . . carried 47,500,000,000 revenue passenger miles on the home front!

Barco Steam Heat Connections are helping to keep maintenance and labor costs at a minimum. They provide the least possible obstruction to the flow of steam and are noted for their extreme simplicity, small number of wearing parts and freedom from leakage.

We're proud of the great record that American railroads are building in this war . . . and we're also proud of our years of service to the railroad industry.

BARCO

MANUFACTURING COMPANY
NOT INC.
1808 Winnemac Avenue, Chicago, Illinois • In Canada—The Holden Co., Ltd.



Air, steam and oil connections between locomotive and tender.

Passenger car steam heat connections.

The Chronological Story Of Timken Bearings On The Northern Pacific . .

1. The Timken Locomotive, No. 1111, was loaned to the Northern Pacific to demonstrate the advantages of Timken Bearings on Oct. 28, 1931.

2. After exhaustive tests the Northern Pacific purchased the Timken Locomotive on January 1, 1933.

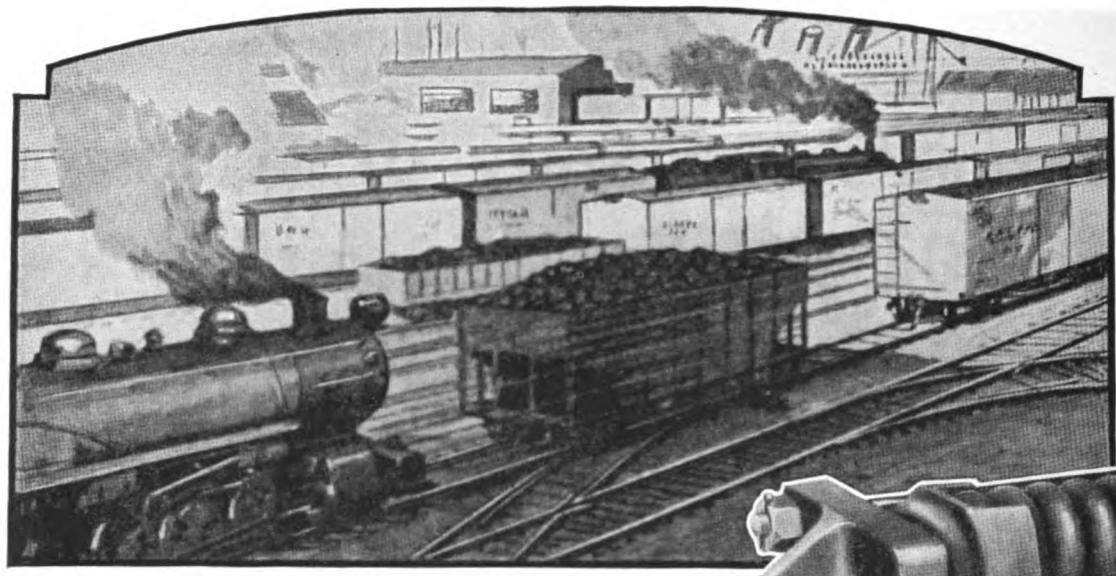
3. Subsequent orders for completely Timken Bearing Equipped engines through the years are as follows:

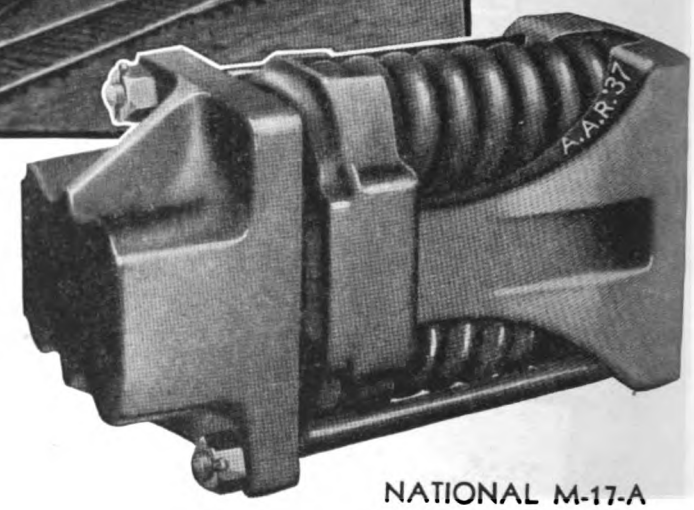
YEAR	NUMBER OF LOCOMOTIVES	TYPE	
1934	10	4-8-4	
1936	14	4-6-6-4	{ Six of these for SP&S.
1937	11	4-8-4	{ Three of these for SP&S.
1937	9	4-6-6-4	{ These converted to Timken Bearings in Northern Pacific Shops.)
1940	12	2-8-8-4	
1940	8	4-8-4	
1940	6	4-6-6-4	
1942	10	4-8-4	
1942	12	4-6-6-4	
1943	10	4-6-6-4	{ Two of these for SP&S.
	total 102		

Could there be a stronger testimonial on the performance and value of Timken Bearings.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
RAILWAY ROLLER BEARINGS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO





NATIONAL M-17-A

Car Protection Is Important

Adequate Draft Gear protection will reduce time out for repairs and increase car mileage.

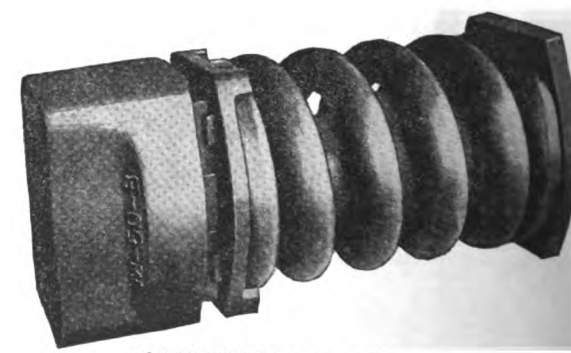
When a loaded freight car shoots down the switch track at excessive speed, standing cars must be protected by draft gears of exceptional shock absorbing ability.

Safe cushioning of the heaviest or the lightest blows is necessary for the protection of car and lading.

It was to meet such extreme conditions that National Draft Gears were designed. Smooth starting action and high ultimate capacity absorb light or heavy blows with the least possible shock.

NATIONAL FRICTION DRAFT GEARS

A. A. R. Approved



NATIONAL M-50-B

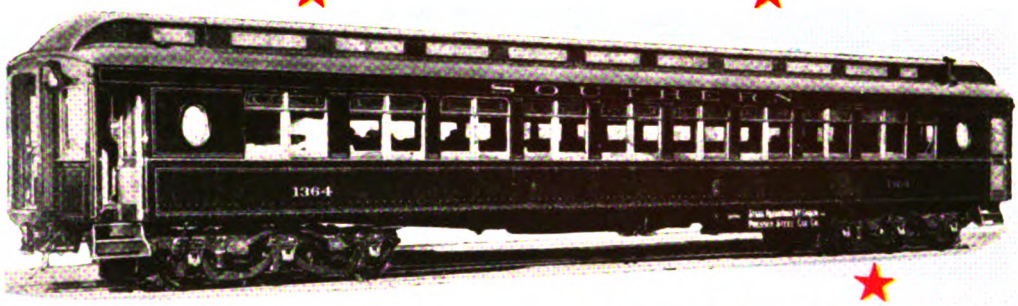
NATIONAL MALLEABLE AND STEEL CASTINGS CO.

General Offices: CLEVELAND, OHIO

Sales Offices: New York, Philadelphia, Chicago, St. Louis, San Francisco.
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.

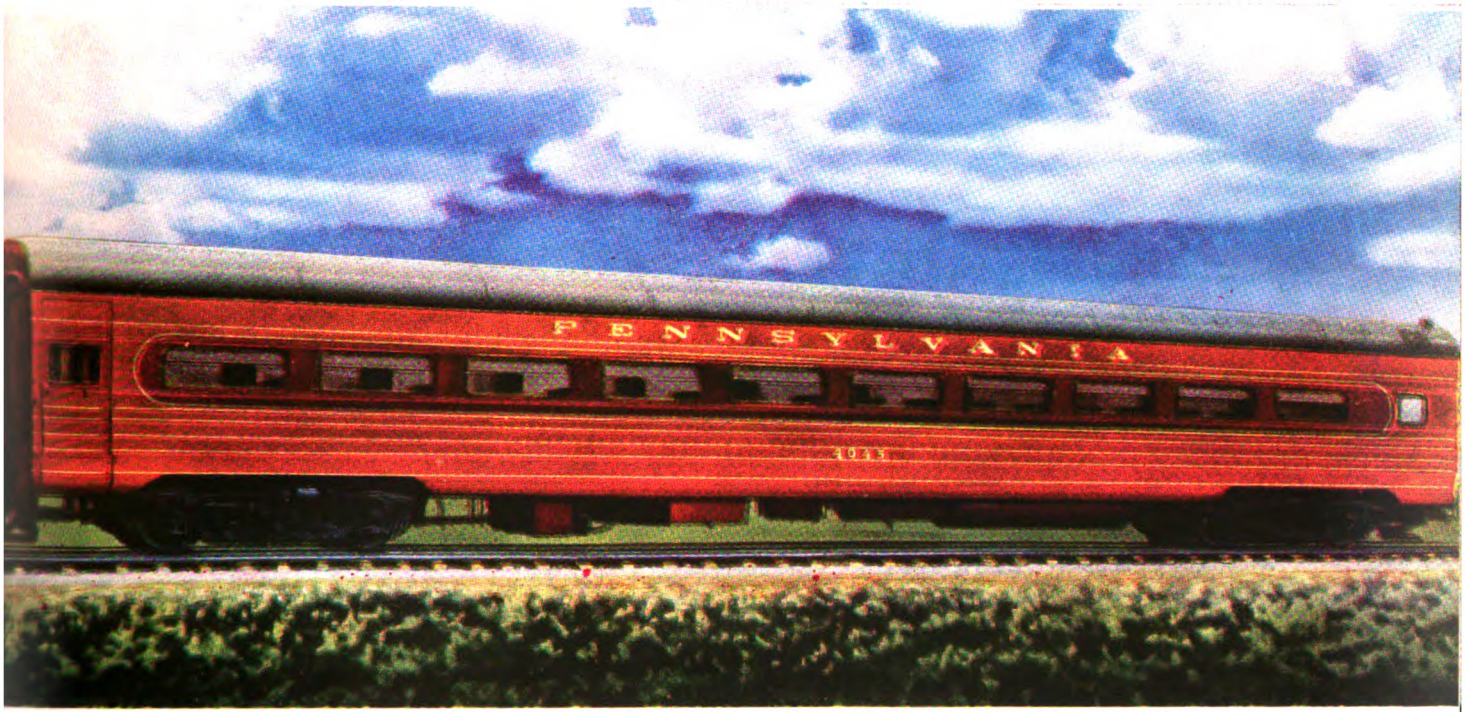
Creators of

PASSENGER EQUIPMENT



MODERN IN 1906

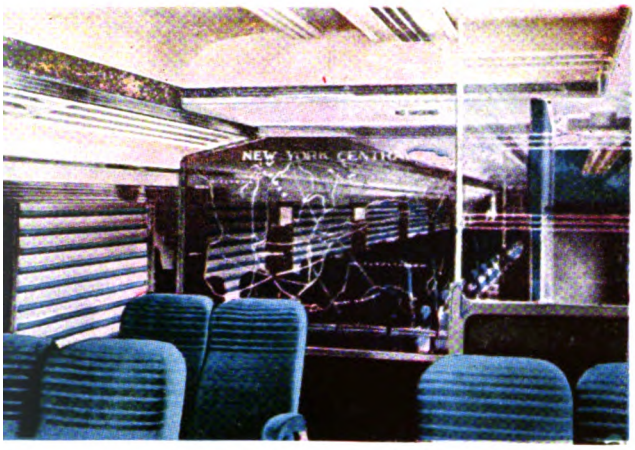
MODERN IN 1943



PRESSED STEEL CAR COMPANY, Inc.

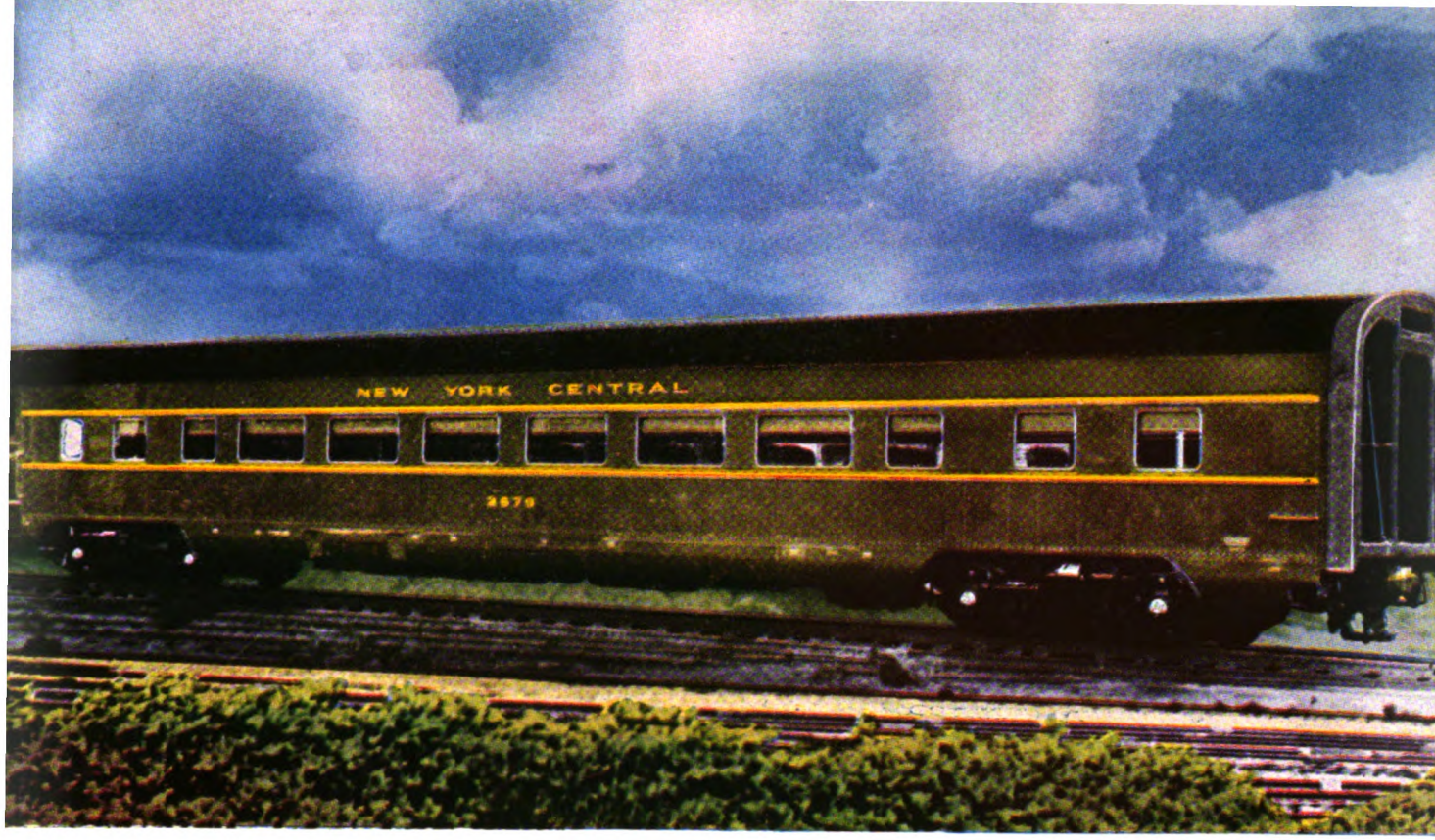
PITTSBURGH PA

★ ADVANCED ENGINEERING ★



BEHIND EVERY PASSENGER CAR CREATION







THE PRESSED STEEL CAR COMPANY, the pioneer builders of steel passenger cars, has been building passenger equipment for over forty years. The two deluxe coaches illustrated on these pages are outstanding examples of modern construction in recent years.

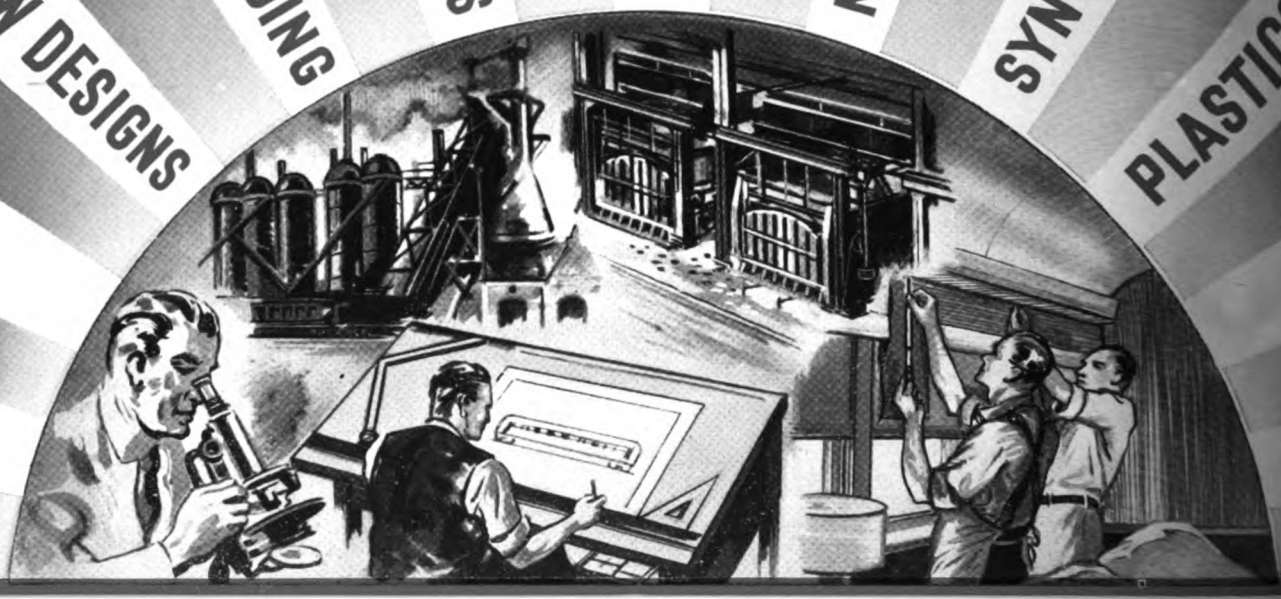
PRESSED STEEL
CAR COMPANY, INC.

PITTSBURGH, PA.

In Winning the Peace

WILL COME NEW AND BETTER PASSENGER CAR DESIGN . . .

NEW DESIGNS
IMPROVED WELDING
NEW ASSEMBLIES
NEW ALLOYS
NEW FABRICS
SYNTHETIC MATERIALS
PLASTICS



WHEN Victory is won, PRESSED STEEL CAR will continue to pioneer in the building of passenger and freight cars.

PRESSED STEEL CAR'S research and engineering staffs, which have demonstrated exceptional ingenuity and versatility in the design and production of war goods, are preparing the peace-time marvels of tomorrow.

What we have learned about new alloys, synthetic chemicals, plastics, new fabrics, improved welding and new assemblies, under the impetus of war, will be forged into newer designs of passenger cars — which will be safer, more economical, durable, more comfortable, and more attractive. As yesterday, so tomorrow PRESSED STEEL CAR'S sole purpose is to help give the railroads the finest in rolling stock.

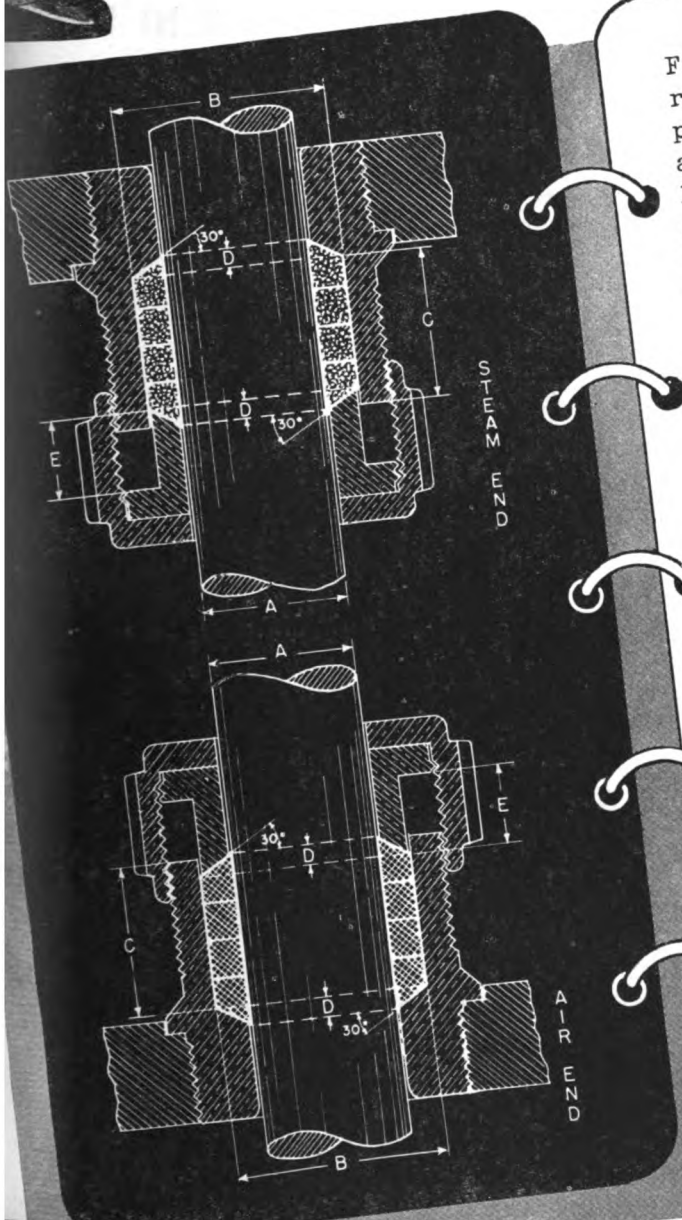
PRESSED STEEL CAR COMPANY, Inc.

PITTSBURGH PA



John Maintenance says:

EXPERIENCE SHOWS AIR PUMPS NEED TWO TYPES OF PACKING



For many years Johns-Manville has recommended the use of one type of packing for the steam end, and another type for the air end of locomotive air pumps. Why? Because the air end is much hotter than the steam end and the air end has no internal lubrication.

Packing Style R-15 for the steam end has a core of asbestos rope with two wrappings of treated asbestos cloth, and is fully lubricated. Packing Style R-55 for the air end has copper wire-inserted asbestos yarn, braided jacket-over-jacket, and is fully lubricated with a high heat-resistant compound.

In applying J-M Combination R-15 and R-55 air pump packing, be sure to get the right packing on the proper rod end. In maintenance, be certain to keep the swabs oil-soaked to lubricate the packing. Do not adjust the gland too tight.

For full details on J-M Packings, write Johns-Manville at New York, Chicago, Cleveland, St. Louis, or San Francisco.

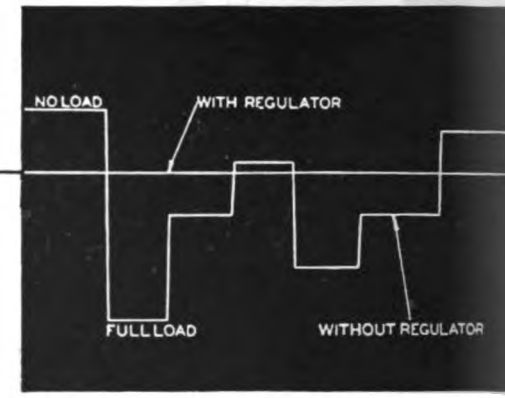
JOHNS-MANVILLE

85 YEARS OF SERVICE TO TRANSPORTATION

JOHNS-MANVILLE JM PRODUCTS

CONTROL

• VOLTAGE
• CURRENT
• SPEED



Realize the Full Value of Your Equipment

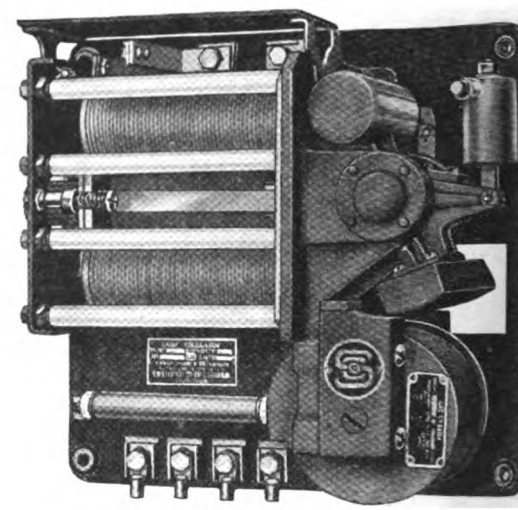
WITH SAFETY CARBON PILE REGULATORS AND REVERSE CURRENT RELAYS

WHEREVER electrical equipment is used, SAFETY Carbon Pile Regulators and Reverse Current Relays provide a positive economical answer to the problem of voltage, current or speed regulation.

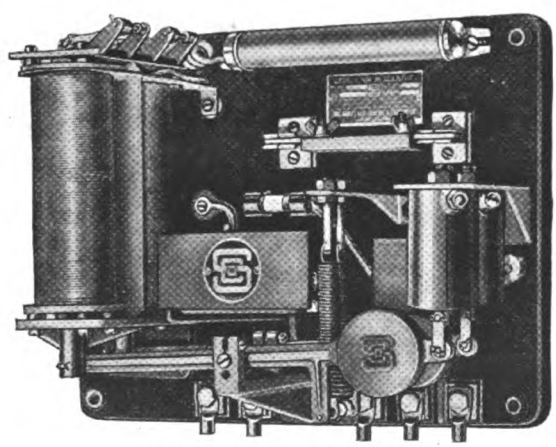
Dependable, low cost self-actuating rheostats of sturdy simple construction, these regulators furnish accurate, automatic control of voltage, current and speed over wide ranges.

These regulators and relays have been time tested by thousands of Equipments in Service in many fields. They are standard equipment on railroad cars and on ships.

SAFETY Regulators effect substantial saving in industries by affording full protection to generating and consuming devices against damage and deterioration because of changes in voltage, current or speed.



TYPE S700E CARBON PILE REGULATOR



TYPE S75EA CARBON PILE REGULATOR

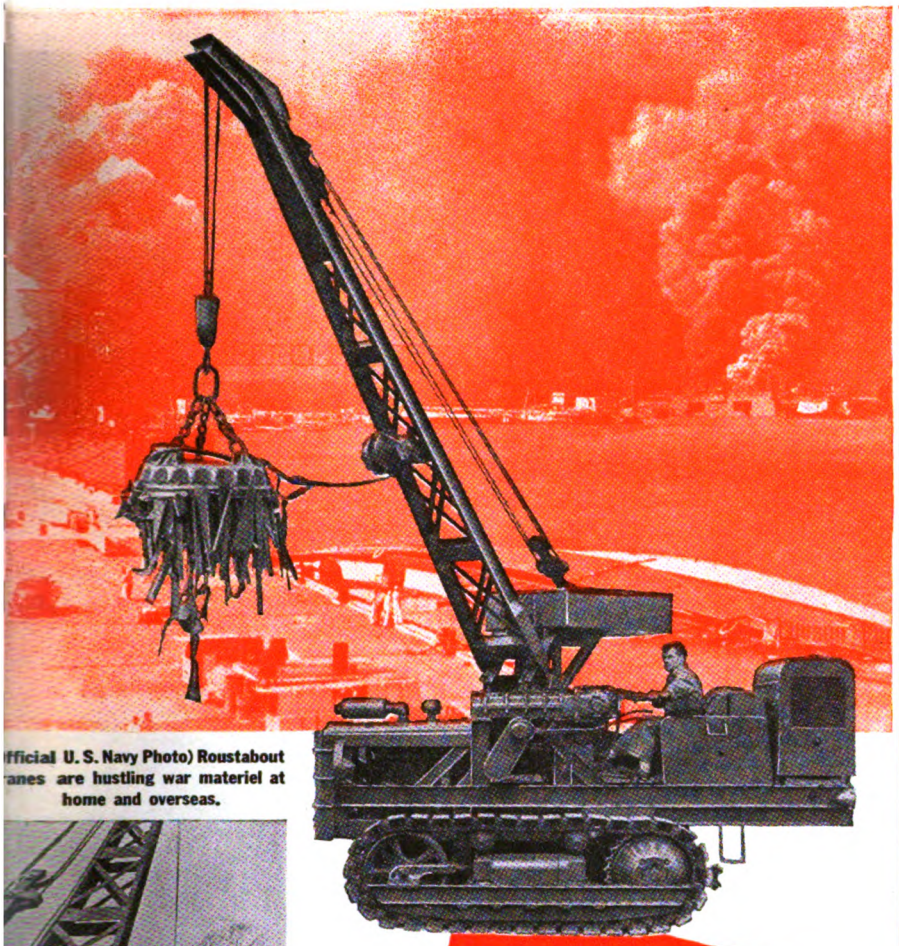
APPLICABLE to all types of alternating and direct current equipment, these regulators maintain voltage or current constant regardless of fluctuations of load or line.

WRITE FOR CIRCULAR WITH LIST OF APPLICATIONS



THE SAFETY CAR HEATING and LIGHTING COMPANY, INC.

NEW YORK - CHICAGO - SAN FRANCISCO - PHILADELPHIA - BOSTON - ST. LOUIS - MONTREAL



(Official U. S. Navy Photo) Roustabout Cranes are hustling war materiel at home and overseas.

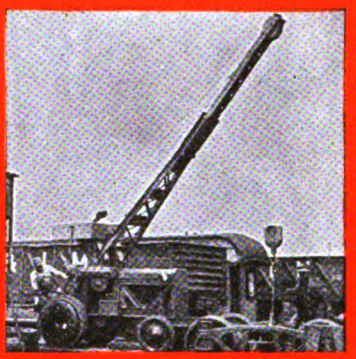


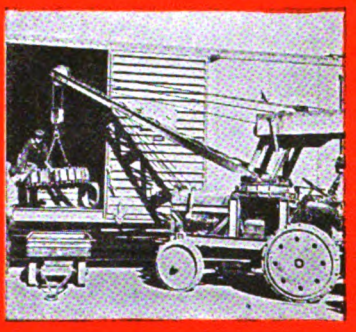
Roustabout Crane handling U. S. 1000 pounder bombs in Britain. (Official Signal Corps Photo).



Roustabout Crane puts motor in place on Liberator Bomber at Consolidated Vultee's San Diego plant.







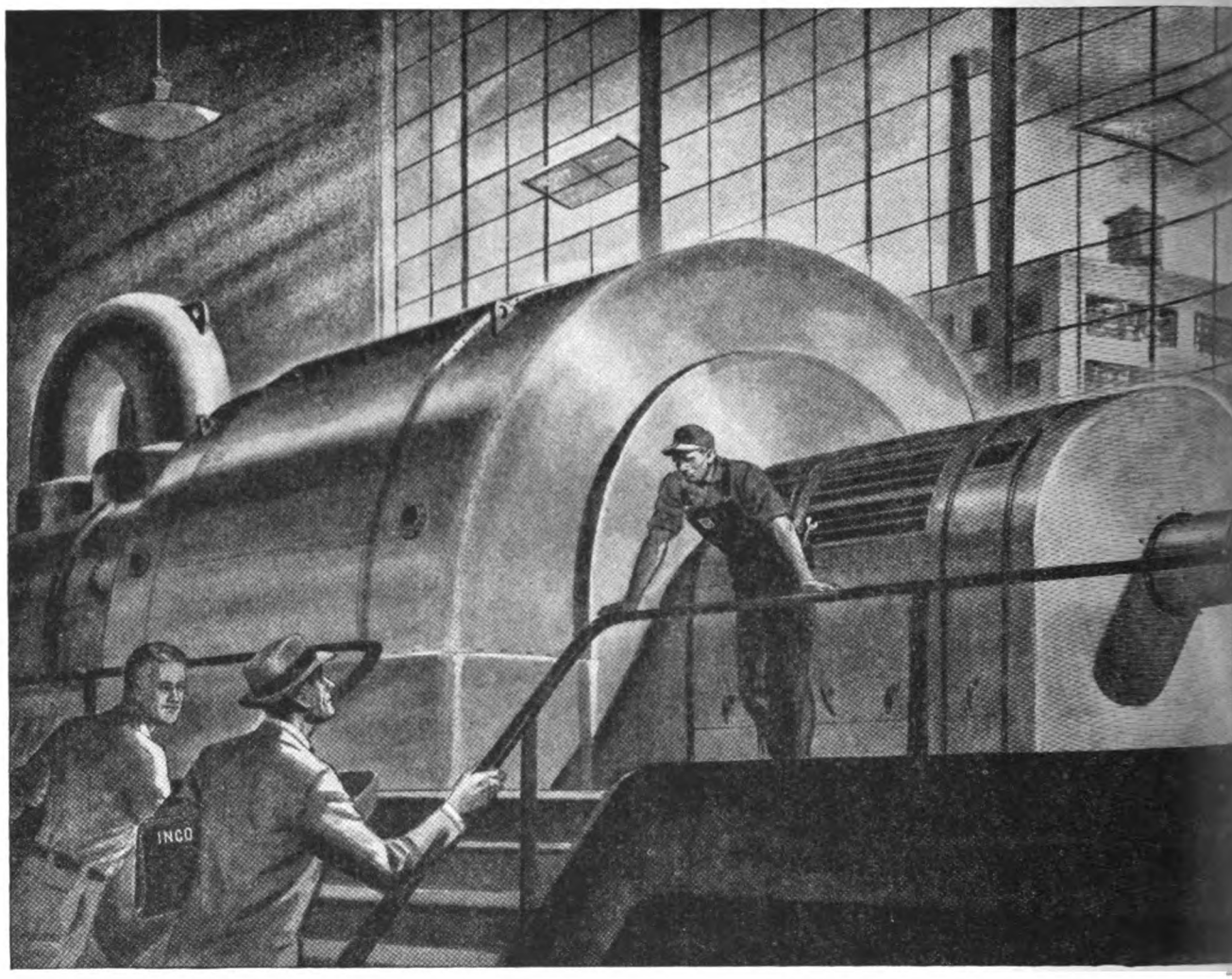


Free-Roving Tractor-Footed ROUSTABOUT CRANES help win the Big Scrap more quickly

ROUSTABOUT CRANE'S handling, stacking, loading speed and versatility—now widely serving armed forces, war plants, air fields and transport organizations—promise you new efficiency and lower costs after the war. For these powerful load-hustlers, on wheels or crawler tracks, are *where* you want 'em *when* you want 'em, preventing delays, keeping things moving, bulky stuff to 5 tons. Easy to operate, all tractor power, full swing boom on ball-bearing turntable, gears in oil—built for years of overwork. For fast action now, for post-war cost cutting, write for the Roustabout Crane story.

THE HUGHES-KEENAN CO.
605 Newman Street, Mansfield, Ohio

ROUSTABOUT CRANES
By Hughes-Keenan
Load-Handling Specialists Since 1904



NICKEL AIDS THE POWER INDUSTRY

to KEEP 'EM OPERATING!

In this day of acute shortages of almost everything, power plant engineers are doing an amazing job of meeting demands for power—the power to keep 'em operating.

Part of this success is due to their foresight in specifying materials that assure long life and withstand the added hardships imposed by ever-increasing peak-load demands.

With the production of tanks, guns, and planes dependent upon power capacity, Nickel makes a valuable contribution towards uninterrupted operation, through the improved properties it imparts to ferrous and non-ferrous alloys used in power plant equipment.

So today the exigencies of war illustrate more clearly than ever the simple truth of the familiar axiom, "A little Nickel goes a long way" toward increasing the dependability of power plant equipment, from turbine blades to high pressure valves, from flange bolts to shaft forgings.

The technical staff of International Nickel has been privileged to cooperate with the power plant engineers and Government authorities who have made possible the great increases in power on which so much of the war effort depends. INCO engineers and metallurgists offer counsel and data to all who desire assistance in the selection, fabrication, and heat treatment of ferrous and non-ferrous metals.

New Catalog Index



New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects—from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

★ Nickel ★

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

GET MORE SERVICE from existing cars with SBS SNUBBERS



Performance of all-coil spring groups can be greatly improved by replacing one A.A.R. spring with an SBS Snubber. This economical method:

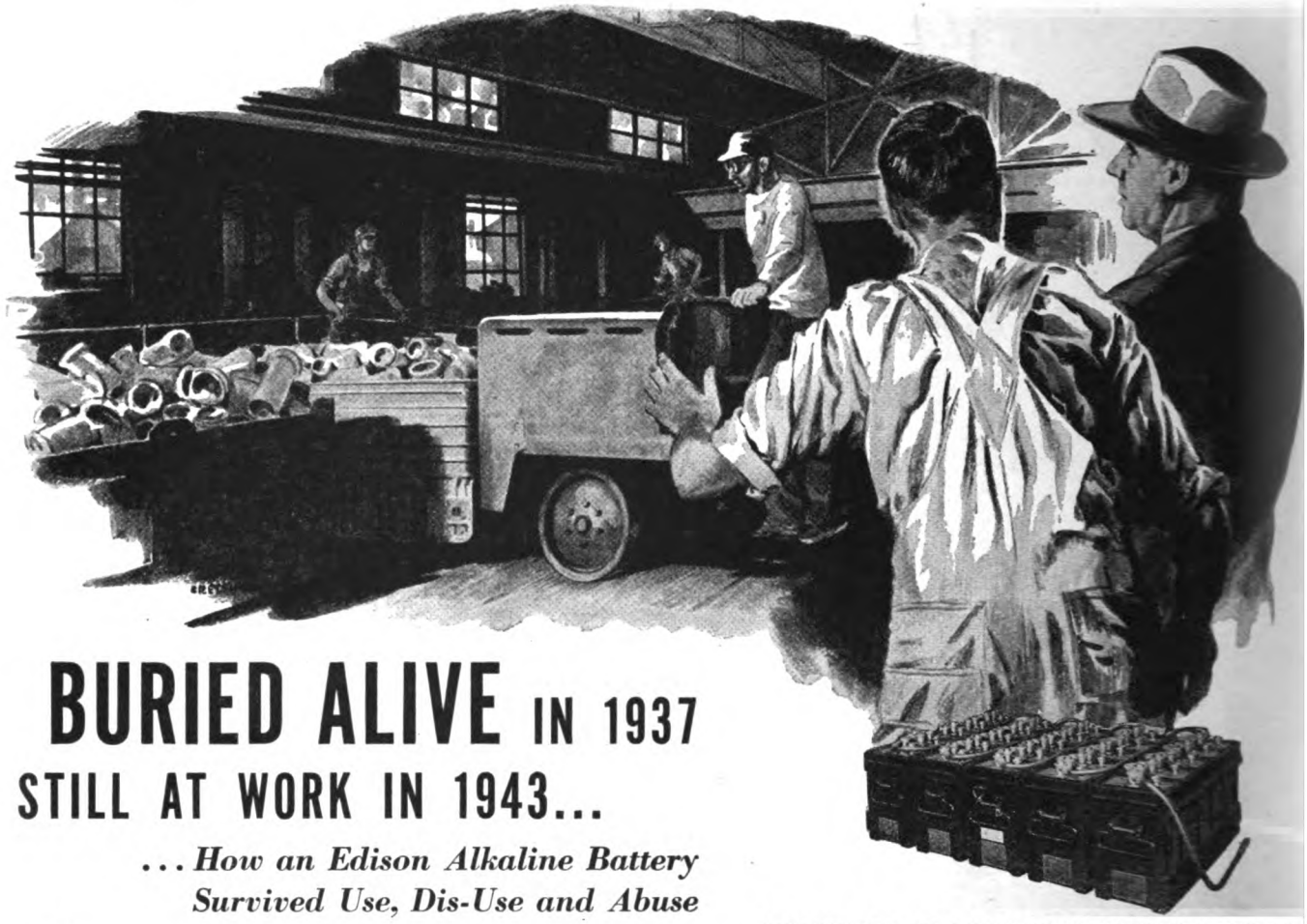
1. **Stops Destructive Car Bounce.**
2. **Prevents Solid Blows.**
3. **Reduces Coil Spring Breakage.**
4. **Keeps Cars off Repair Track.**
5. **Lowers Track Maintenance.**

Due to the Rubber Shortage, the type SBR Snubber has been replaced by the SBS—in which transverse coil springs are substituted for the rubber block. Proved in laboratory and road tests, the SBS Snubber has been in actual service for over two years.

THE SYMINGTON-GOULD CORPORATION

Works: ROCHESTER & DEPEW, NEW YORK

New York • Chicago • St. Louis • Baltimore • Boston • San Francisco • In Canada—ADANAC SUPPLIES, LTD., Montreal, Que.



BURIED ALIVE IN 1937
STILL AT WORK IN 1943...

... How an Edison Alkaline Battery Survived Use, Dis-Use and Abuse

In 1937, a midwestern foundry changed hands after being shut down six months. The electrician of the new owners, in the course of putting the industrial trucks into operation, found one of the batteries buried under a mound of earth beside an open trench.

He knew it must have been there at least six months and, although it was an Edison Alkaline Battery, he was naturally doubtful whether it was still serviceable. Nevertheless, he ordered it cleaned, painted and charged. Much to his surprise, it performed satisfactorily in every way when put into one of the trucks. Now, six years later, the electrician tells an Edison engineer that the same battery is still in regular service.

Edison Alkaline Batteries are meant to stand use—long use and hard use, in mines, railroads and industry. They can also stand disuse, indefinitely, if discharged, short-circuited and properly stored. But the fact that they can, and often do, survive outright abuse is striking evidence of their great reserve of dependability under all conditions.

Some of the unique characteristics which enable the Edison Alkaline Battery to stand up under use, disuse and abuse are cited in the column at the right.

ADVANTAGES OF THE EDISON ALKALINE BATTERY FOR RAILWAY-CAR SERVICE

- ★ It is light in weight. Its use reduces total car weight. It is easy to handle.
- ★ It is durable mechanically. High strength steel construction is used in the container, grids, pole pieces, etc. The electrolyte is a preservative of steel. It requires no renewal of separators throughout its long life.
- ★ It is foolproof electrically. It withstands the over-charging and over-discharging inherent in railway-car service. It is not injured by accidental charging in reverse.
- ★ It can be charged rapidly. It may be charged at full normal rate throughout the entire length of charge and is not subject to finish rate limitations. It requires no equalizing.
- ★ It withstands temperature extremes. It is not damaged by freezing. Free air spaces on all sides of all cells provide ventilation for rapid cooling under high temperature conditions.
- ★ It is free from ordinary battery troubles. It is not subject to sulphation, shedding of active material, buckling of plates, jar breakage or other common causes of battery failure.
- ★ It is simple to maintain. Merely charge adequately, add pure water, keep clean and dry.
- ★ Its tray assembly and cell connections are extremely simple.
- ★ Its life is so long that its annual depreciation cost is lower than that of any other type of storage battery.

EDISON STORAGE BATTERY DIVISION, THOMAS A. EDISON, INCORPORATED, WEST ORANGE, NEW JERSEY

Edison

ALKALINE BATTERIES



If you have not received a copy of this interesting new A. S. F. book telling a graphic story of our experiences in road testing freight car trucks, be sure to write for a copy. You will find it full of photographs showing laboratory cars and trains, testing apparatus and developments. It is an eye-opening record of the progress we have made in the scientific measurement of freight car riding qualities. Just tear off the signature on this ad and attach your business card or write your name and address in the margin and mail to us.

AMERICAN STEEL FOUNDRIES

CHICAGO

MINT-MARK OF FINE CAST STEEL

STANDARDIZE WITH EX-CELL-O PINS AND BUSHINGS

Ex-Cell-O hardened and ground steel bushings and pins are now used by more than 125 railroads and manufacturers of railroad equipment. Experience has shown that from four to six times longer service is obtained when Ex-Cell-O products are used. . . . The parts to which Ex-Cell-O pins and bushings are applied wear longer, as do also other parts which suffer from shock and rigorous service when improperly made bushings and pins are used. . . . *Ex-Cell-O offers hardened and ground bushings and pins and expert engineering service to help you obtain better and more economical performance.*

EX-CELL-O CORPORATION • DETROIT

XLO

EX-CELL-O *for* PRECISION

For complete list of standard sizes and other data on railroad hardened and ground steel pins and bushings, send for Bulletin 32301.





Write for the BUDA jack pocket manual

BUDA

THE BUDA COMPANY, Harvey (Chicago Suburb) Ill.

LANDIS CHASERS ARE EASILY AND QUICKLY REGROUND



A simple grinding operation renews the entire cutting edge and leading feature, retaining, after each grind, the initial accuracy of the chaser.

Avoid overheating, use mechanical rests, check throat and lip rake angles, grind uniformly and only so much of the chaser as is worn and you are assured quality threads and long chaser life.

The Finest Thread Cutting Tool in Industry

12 Features of the LANDIS TANGENTIAL CHASER

1–Permanent throat permits close to shoulder threading throughout life of chasers
2–Rake angle range covers all machinable materials
3–Free cutting condition permits maximum cutting speeds
4–Simple grinding operation renews entire cutting edge and leading feature
5–Line contact with work lessens friction and minimizes thread distortion
6–Leading feature insures thread of accurate lead
7–Lateral absorption of cutting strain reduces vibration and chaser breakage
8–Right and lefthand threading feature reduces chaser equipment
9–Standard chasers thread all diameters with proper chaser holders
10–Interchangeability of chasers lowers operating cost
11–Chaser length provides exceptionally long life and low tool cost
12–Permanent throat gives equal distribution of cut

LANDIS MACHINE COMPANY

WAYNESBORO, PA., U.S.A.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

HOW AND WHY

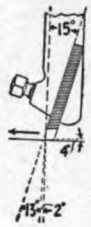
WILLIAMS' TOOLS AID WAR PRODUCTION

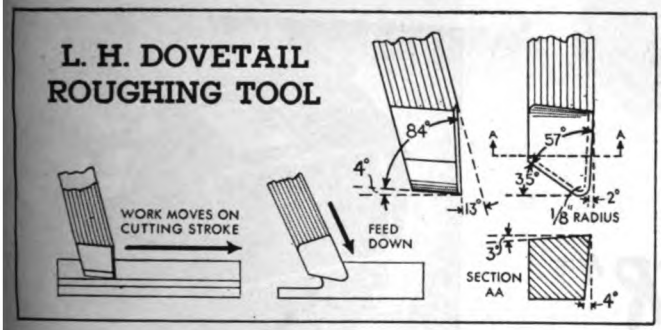


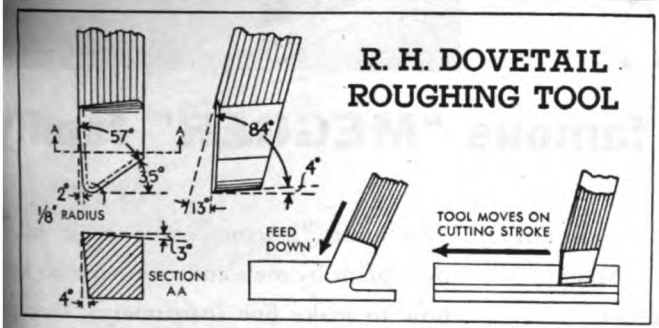
GRINDING CUTTERS FOR WILLIAMS' TOOL HOLDERS

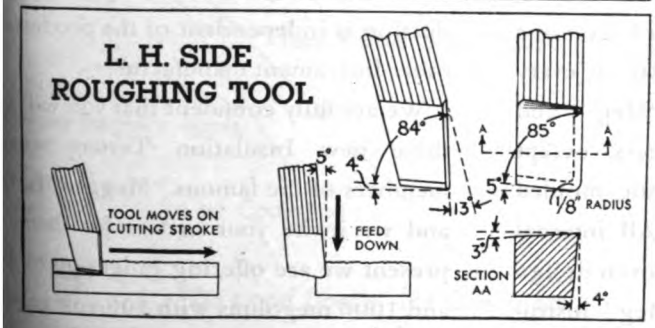
DATA SHEET D, covering the various Shaper tools used in Williams' Holders for machining Cast Iron.

● Williams' Turning-Tool Holders are regularly used for Shaper work. They are made in eight sizes for cutters 3/16" to 3/4" square. Since the cutter channel is broached at a 15° angle, as shown at right, allowance must be made for this fact when grinding cutters. *Grinding* and *applied* angles are given below.





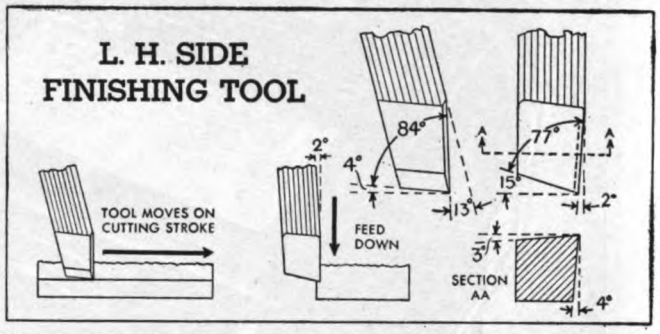


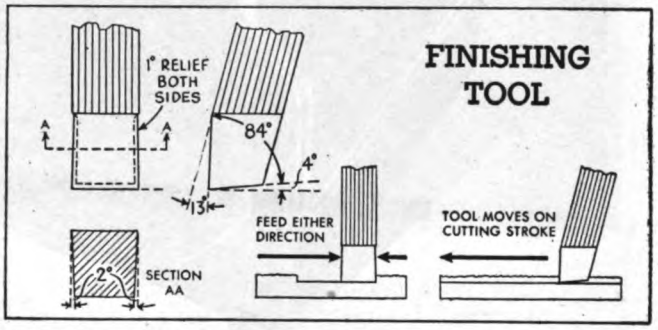


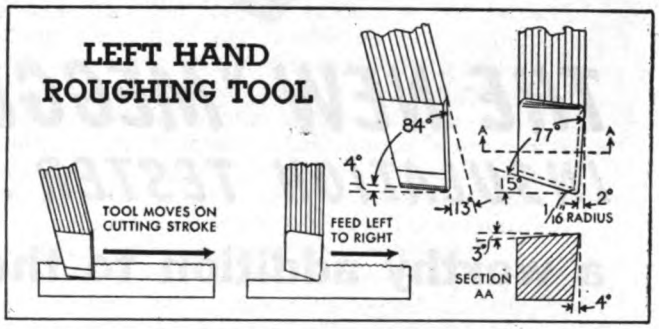
Sold by Leading Industrial Distributors Everywhere

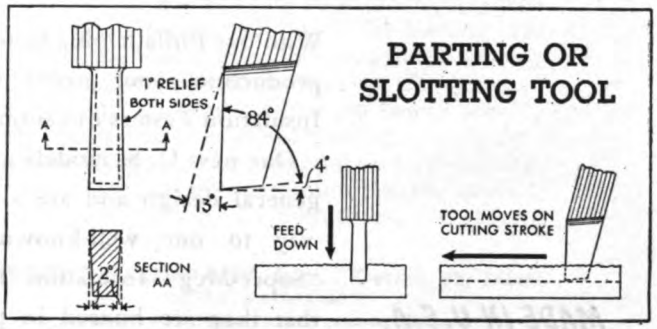
J. H. Williams & Co., Buffalo 7, N. Y.

© J. H. W & CO., 1943



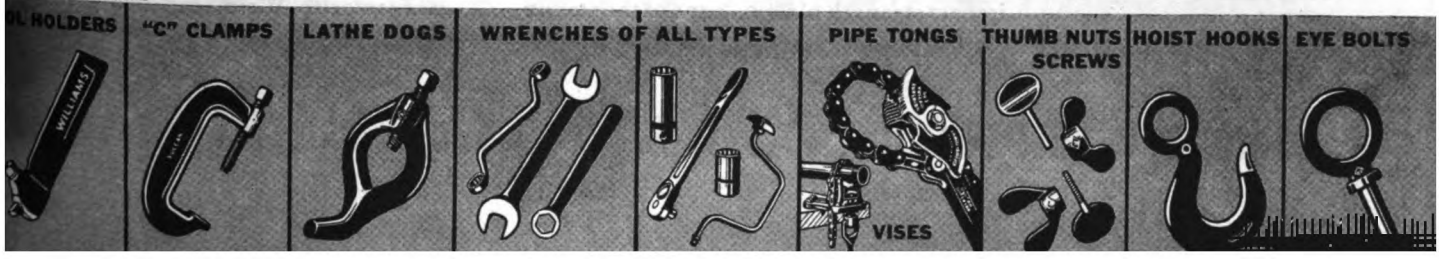


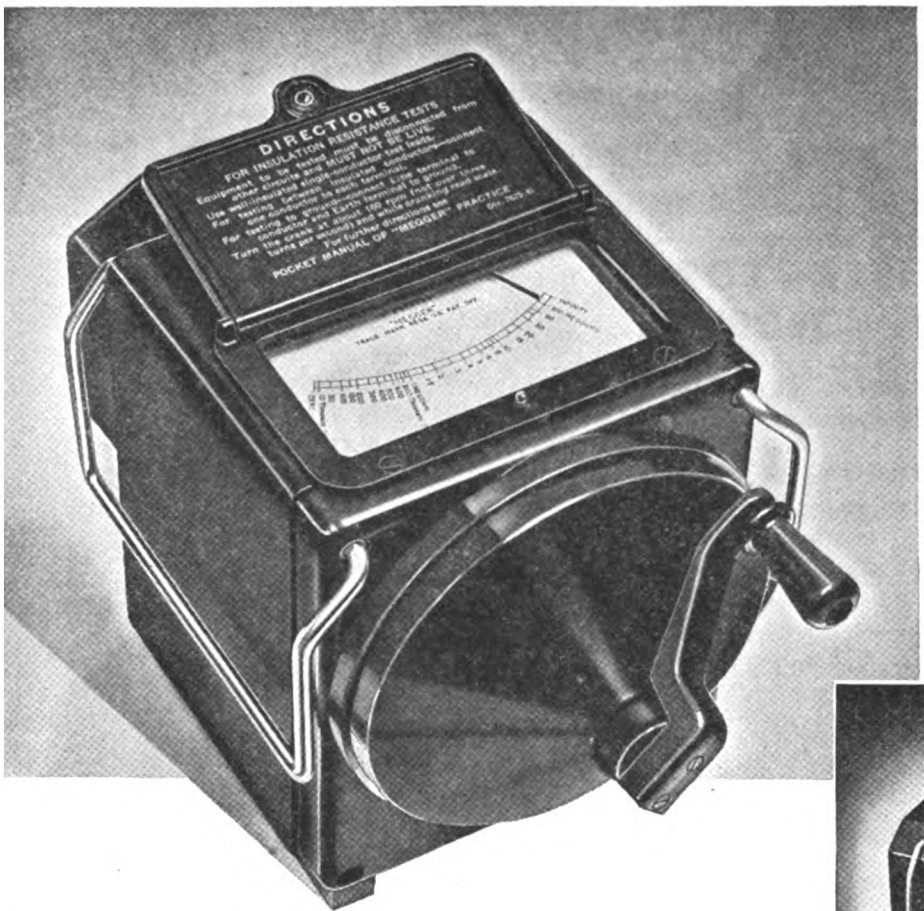




Data Sheets A, B and C on this subject have already appeared. Additional Data Sheets on grinding of other cutters for Williams' Tool Holders will follow. Reprints of Data Sheets are available on request.

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SUPERIOR DROP-FORGED TOOLS
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for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS





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INSULATION TESTER . . .

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- RUGGED
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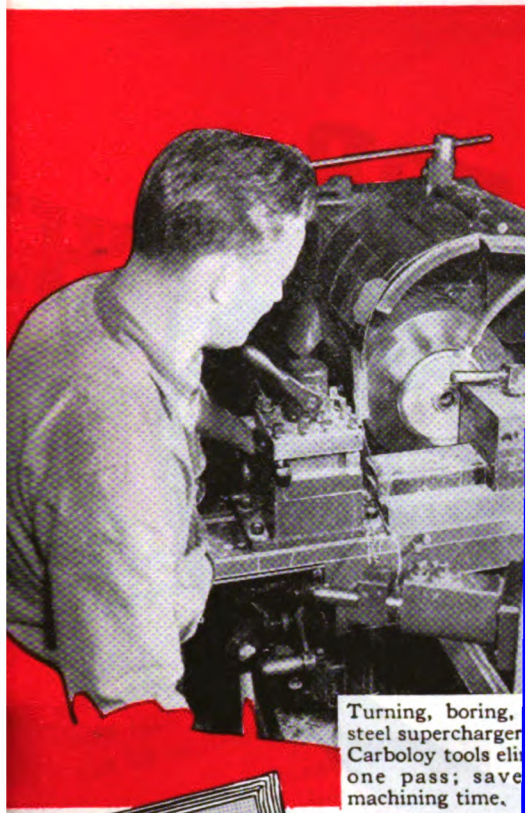
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The entire instrument is built in our own plant by men and women who know how to make fine instruments. Our production is independent of the products of other instrument manufacturers.

We are fully confident that you will find these new Insulation Testers worthy members of the famous "Megger" family, and we invite your orders for them. At present we are offering ranges up to 100 and 1000 megohms with 500-volt generators. We continue to supply various other types and ratings of "Megger" instruments as formerly. Write for new descriptive Bulletin 1735-"X"

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Turning, boring,
steel supercharger
Carboloy tools eli
one pass; save
machining time.



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Tool Rakes and

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Use of Coolants

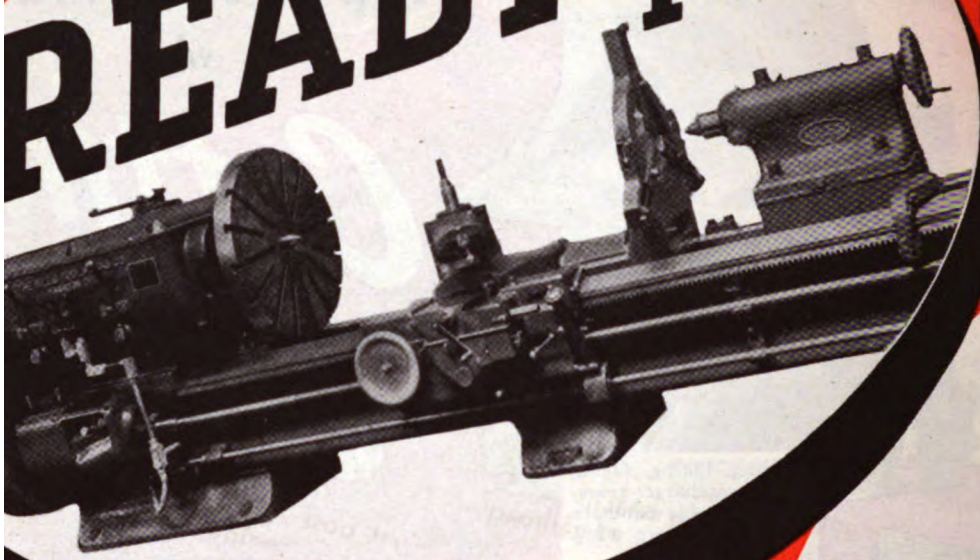
"Do's and Dont's" for Op

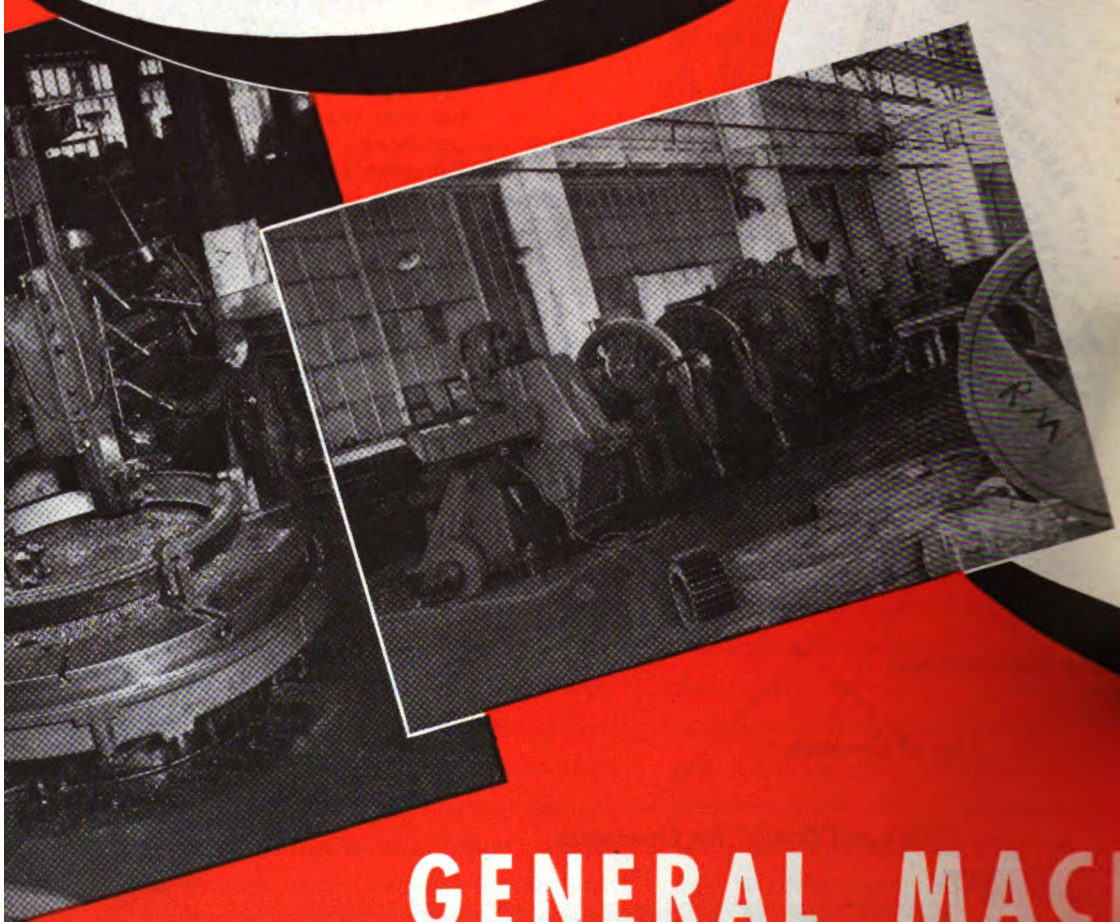
TUNGSTEN CARBIDES
For Cutting
CAST IRON
and
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FOR HEAVY HOGGING • • • PR

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GENERAL MACH
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Offices in

Guide to Top Performance when Cutting Steel



Turning, boring, facing steel supercharger gears. Carboloy tools eliminate one pass; save 81% machining time.



Send for this New, Pocket-size Manual

Carbide Grade Selection

Correct Cutting Speeds

Chip Breaker Design

Tool Rakes and Angles

lachine Requirements

Use of Coolants

"Do's and Dont's" for Operators

For top performance when you cut steel with carbide tools ★ Cut at high speeds, in general, not less than 200 feet per minute ★ Use feeds not less than .010″ per revolution (for medium and heavy cuts), and preferably .015″ to .025″ ★ Fit correct chip breaker to each job (the ground-in, step-type is usually best) ★ If you use a coolant, provide heavy, continuous stream ★ Keep tools sharp (excessively dull tools cause breakage) ★ Use rigid set-ups; with minimum overhang, and part chucked firmly. These factors are particularly important for best results.

Important, too, is the type of carbide you select. Today, more than 60% of all Carboloy Cemented Carbide produced for machining purposes is used for cutting steel. In leading war plants throughout the nation—you find Carboloy tools giving top performance on all types of steel cutting, ranging from extra heavy jobs to light, high-speed precision finishing.

A new 16-page pocket manual on steel cutting, to help your plant get maximum results, is available free on request. In quantities, for general distribution; if desired.

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TUNGSTEN CARBIDES For Cutting CAST IRON and Non-Ferrous Metals

CARBOLOY
(TRADEMARK) CEMENTED CARBIDES

TITANIUM TANTALUM CARBIDES For Cutting STEEL

FOR HEAVY HOGGING • • • PRECISION FINISHING • • • INTERMITTENT CUTTING

Ask for this book



Tells you how to take care of small tools-Bolt Clippers, Files, Taps, Drills, etc. The boiled down facts to help you get the most out of these tools-use, wear, repair and selection. Handy pocket size. Just ask on a post card for- Porter's Tool Maintenance Book it's FREE

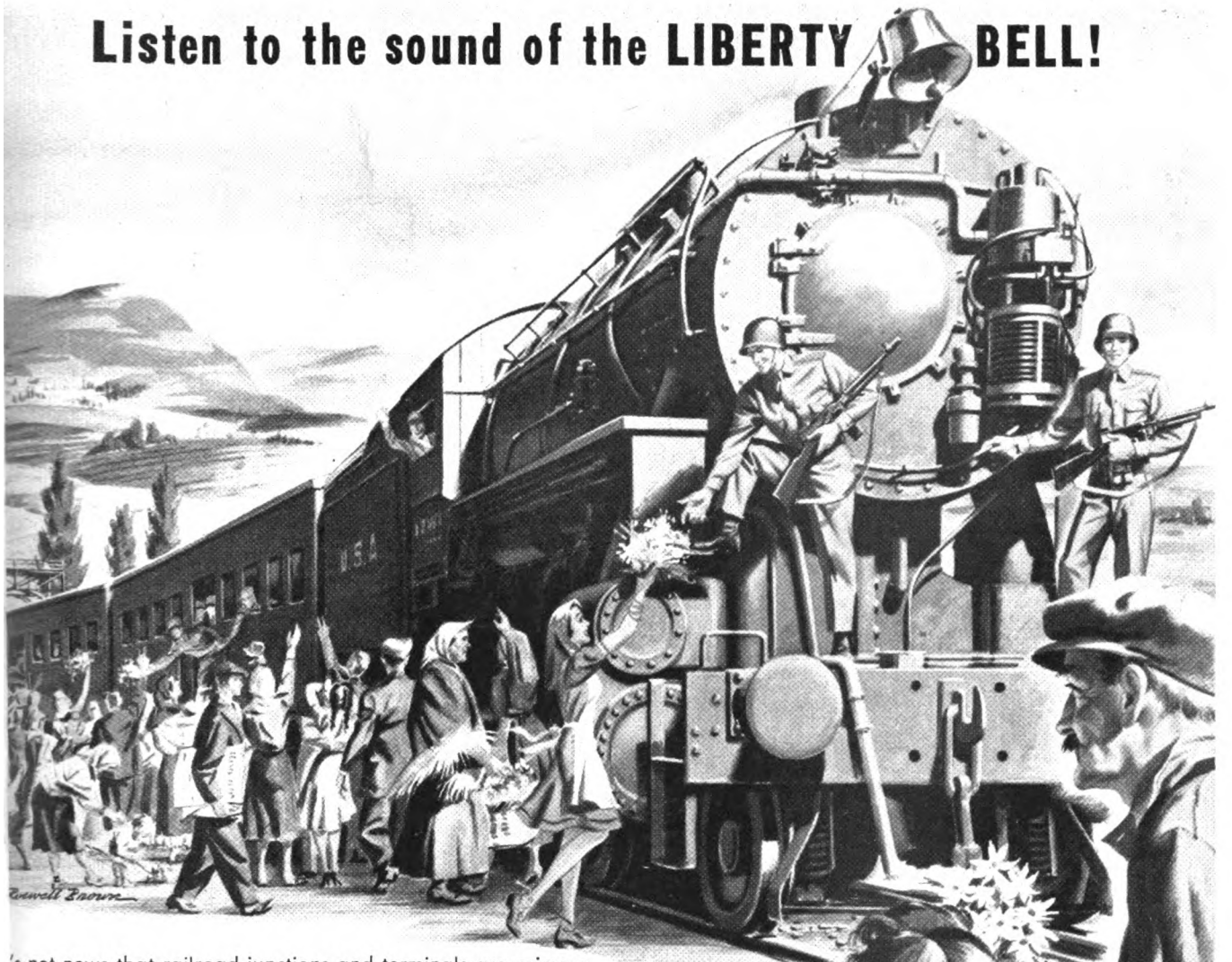
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PORTER CUTTERS

BOLT CLIPPERS — AUTOBODY REPAIR TOOLS — PRUNERS

H. K. PORTER, INC., 415 ASHLAND ST., EVERETT, MASS.

Listen to the sound of the LIBERTY BELL!



's not news that railroad junctions and terminals are primary
ilitary objectives. Railroad terminals in Berlin, Dusseldorf and
remen are even now being blasted by devastating bombing
aids to soften Nazi Germany for the invasion of "Fortress Europe."

We've all read of Hitler's characteristic perversion of railroad
olling stock to the transporting of slave labor into the Reich.

. . and this we know, too . . . someday soon, locomotives are
oing to roll along the European countryside—carrying freedom
o the peoples of oppressed lands . . . carrying freedom in
he person of United Nations' fighting men; food from the
Americas, and clothing, too.

Then the locomotive bell will ring out across Europe carrying the sound of a new dawn of freedom to men and women everywhere!

Union Asbestos insulations are used by most U. S. railroads to conserve steam—thus save fuel and increase passenger comfort and operating efficiency. U. S. locomotive builders are applying Unarco insulations to all locomotives being built for overseas duty.

INSULATION FOR MARINE, RAILROAD, AVIATION AND INDUSTRIAL USE

UNION ASBESTOS AND RUBBER CO.

OFFICES: CHICAGO, NEW YORK, SAN FRANCISCO
PLANTS: CICERO, ILL., BLUE ISLAND, ILL., PATERSON, N. J.

To make *Good* wheels

BETTER

a.c.f. developed this high-speed

As one of the largest producers of chilled tread car wheels, a.c.f. long ago recognized the extreme importance of having its wheels truly concentric with the axle. To this end, it developed for its own use the a.c.f. High-Speed Wheel Grinder.

This simple and efficient device proved most successful. Not only did it afford a speedy and inexpensive means of insuring true concentricity, it also produced a distinctly *better* wheel. It did this by producing a wheel with a smooth ground surface for rail contact. It also afforded a perfect means of detecting any possible imperfections.

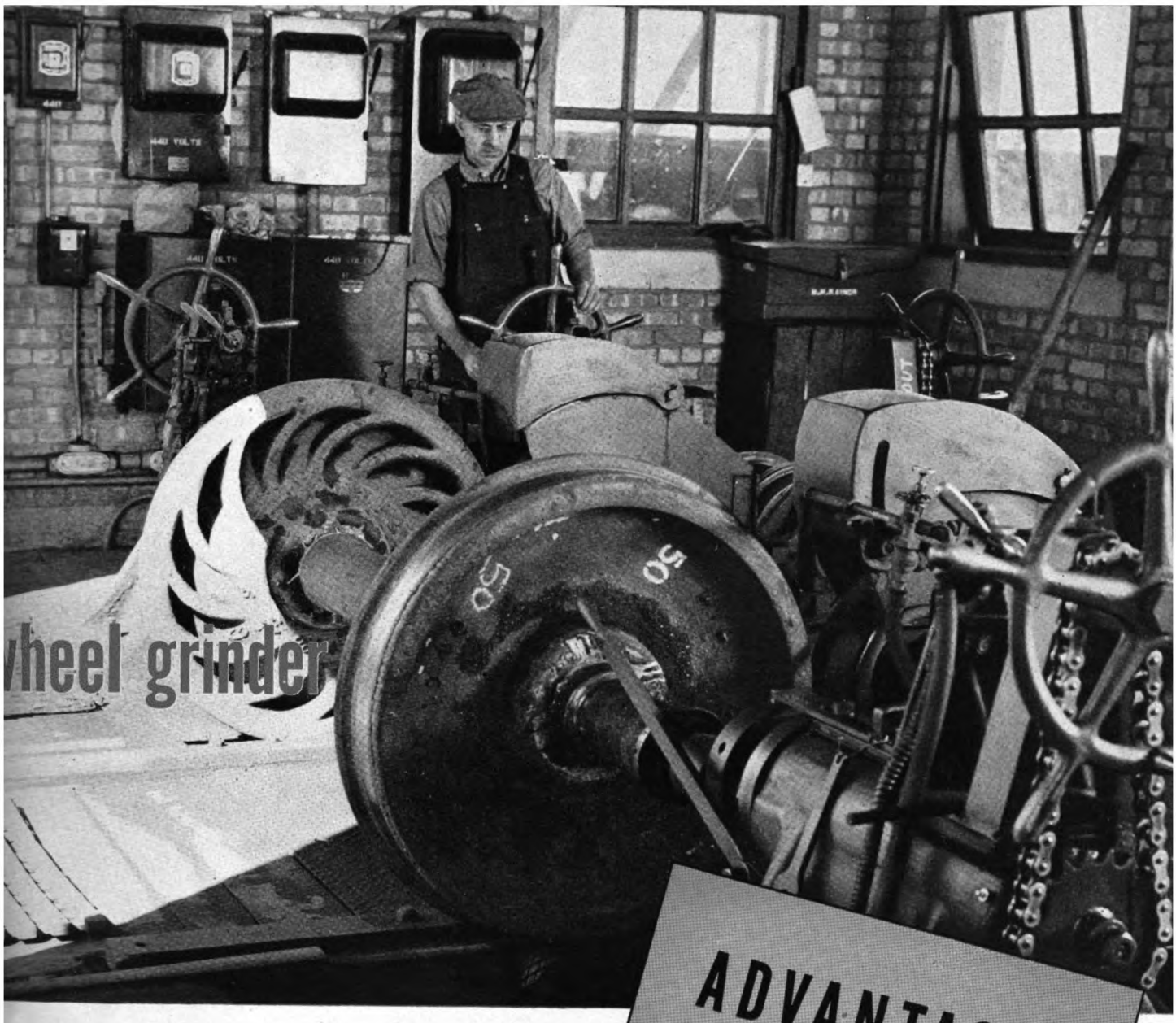
Originally developed as merely another of a.c.f.'s special tools and facilities for the production of better railroad equipment, this highly practical a.c.f. High-Speed Wheel Grinder is now used by many railroads in their wheel maintenance work.

Users report the operating cost of the a.c.f. High-Speed Wheel Grinder is insignificant, and savings effected in salvaging wheels taken out of service for 'slid flat', 'out-of-round', 'worn hollow', 'sharp flanges', etc., and in remounting second-hand materials, will cover the purchase price in two or three years use.

a.c.f.

AMERICAN CAR AND FOUNDRY COMPANY

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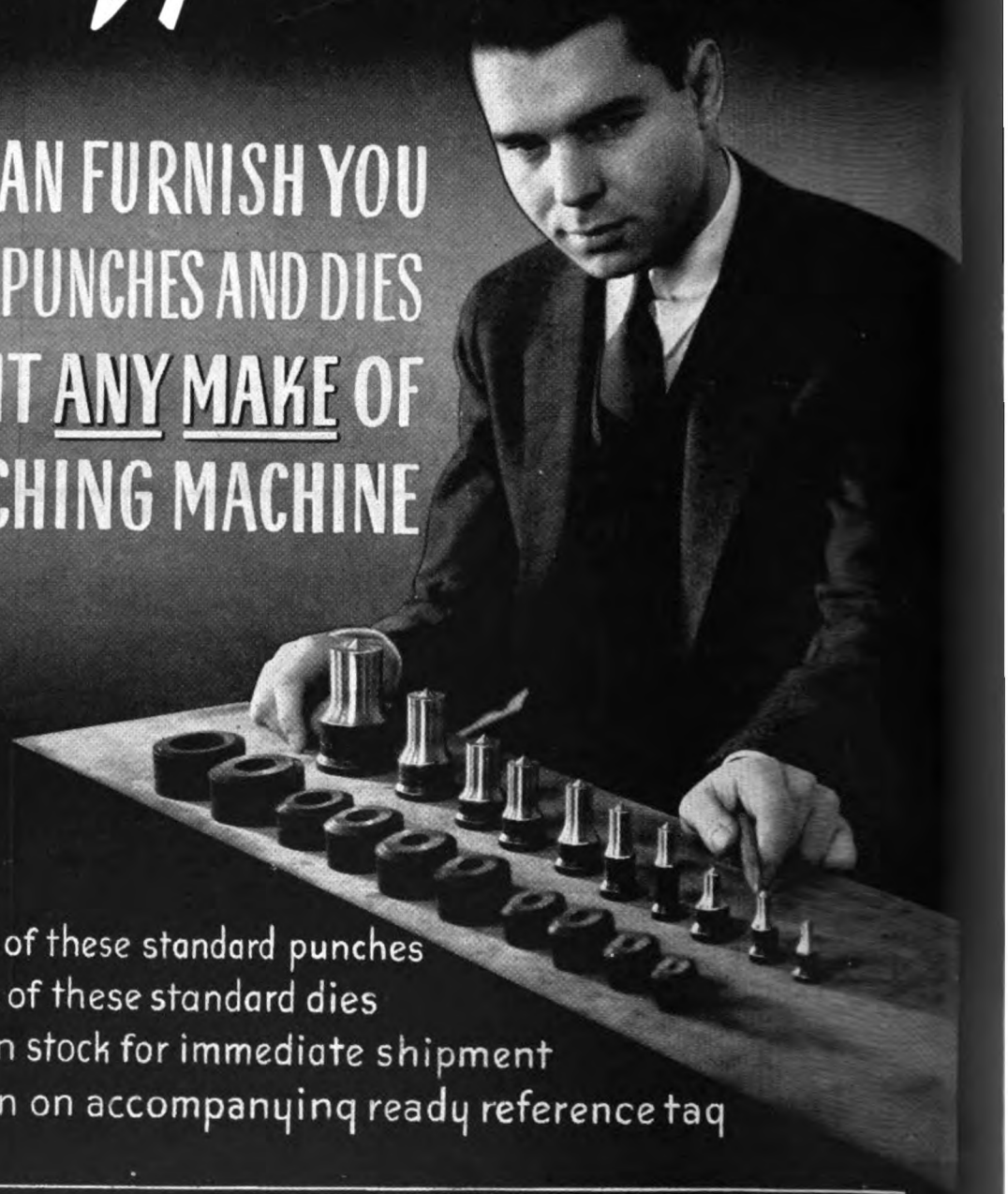
wheel grinder

The A.C.F. High-Speed Wheel Grinder finishes mounted pairs of wheels with treads of identical circumference, concentric with the journal, and presenting a perfectly smooth surface for rail contact. The floor to floor grinding time for a pair of mounted new chilled tread wheels is 3 to 4 minutes, and the operation affords a perfect means of detecting imperfections in wheels as furnished, or faulty workmanship in boring, mating, and mounting.

ADVANTAGES

1. Increases wheel life.
2. Lowers maintenance of trucks, brakes, and rails.
3. Reduces train resistance.
4. Reduces vibration.
5. Cuts damage to fragile ladings.

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WE CAN FURNISH YOU
WITH PUNCHES AND DIES
TO FIT ANY MAKE OF
PUNCHING MACHINE

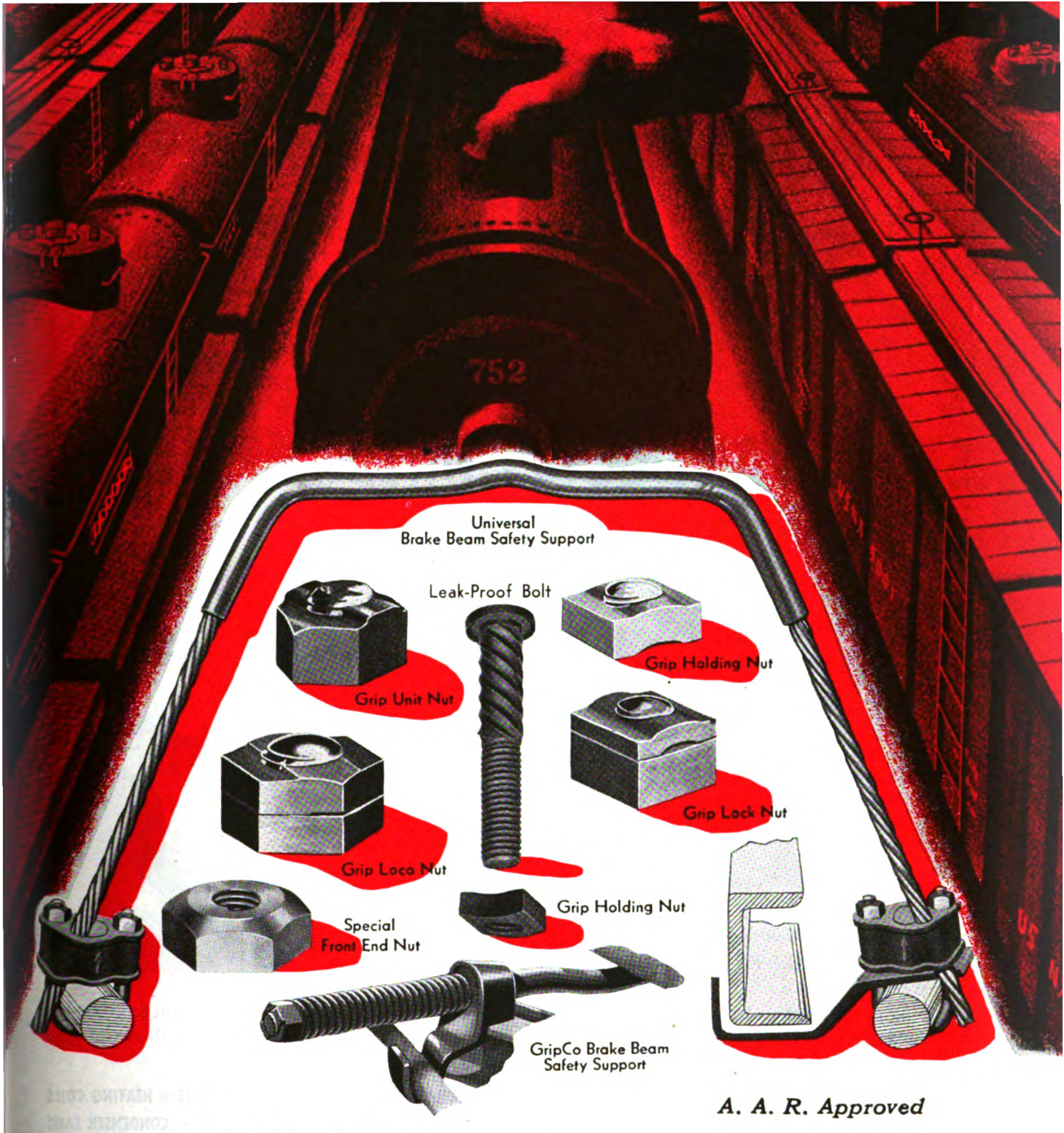
399 sizes of these standard punches
241 sizes of these standard dies
carried in stock for immediate shipment
as shown on accompanying ready reference tag

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When you need Punches and Dies or other Small Tools such as Chisel Blanks, Coupling Nuts, Rivet Sets, Shear Blades, etc. specify Clevelands and your order will be shipped without delay.

Small Tools THE CLEVELAND PUNCH & SHEAR WORKS COMPANY *Cleveland, Ohio*

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the GRIP NUT GROUP . . .

Wherever ladings move on rails, GRIP NUT products will do an outstanding job. Rolling stock and motive power will stay in uninterrupted service with minimum maintenance when GRIP NUT COMPANY products protect vital points.

Exclusive, patented features—strength with minimum weight—simple application—dependable, long service—earned GRIP NUT COMPANY products widespread acceptance by Railroads, Carbuilders and Industries for both new and maintenance work.

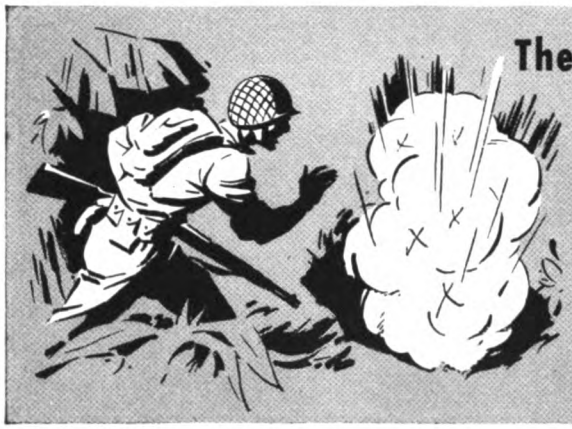
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310 South Michigan Avenue **CHICAGO 4, ILLINOIS**

serving American Railroads since 1906

Regional Offices: St. Paul, Minneapolis, St. Louis, San Francisco, Cleveland, Chicago, Salt Lake City, Salisbury, N. C., Pittsburgh, New York



The bomb he throws into his own foxhole

Newest weapon of the U. S. A. in combating insects is an "exterminator bomb." Small, light and now standard equipment, it's tossed into foxholes, shell craters—wherever else our boys must spend a night in the open—to disinfect, to clean out insect pests. It's another case of peacetime commercial development meeting a vital wartime need, and it's just . . .

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STURTEVANT COOPERATES WITH RAILROADS IN CONSERVING FREON!

Specially skilled men assigned to furnish

EMERGENCY REPAIRS AND REPLACEMENTS



Although there's no way of getting new Freon, there are plenty of ways of losing the Freon you have. In safeguarding existing supplies, Sturtevant offers you fullest cooperation.

Realizing the pressure under which maintenance men are working—and the importance of keeping air conditioned cars on the road—we have set up a special department to repair damaged equipment—or replace it, if necessary, under existing government regulations.

Take advantage of the opportunity to repair condenser and evaporator coils, for example, while this equipment is not in service. If, in inspecting and shutting down these units for winter operation, you find they require attention to prevent loss of Freon when the refrigeration end is put back into operation—send the equipment to us for an estimate on repairs or replacement parts.

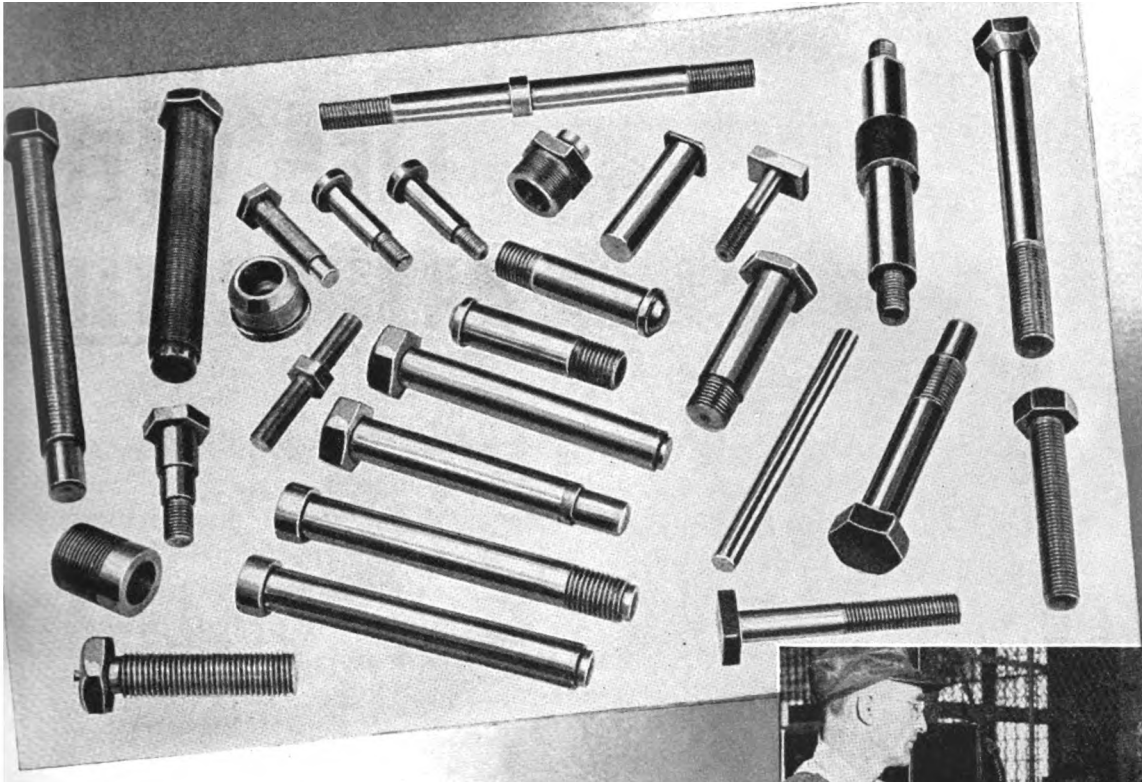
Here is the air conditioning equipment Sturtevant is prepared to repair or replace with reasonable promptness:—

CONDENSER COILS ★ EVAPORATOR COILS ★ HEATING COILS
ICE WATER COILS ★ CAR FAN UNITS ★ CONDENSER FANS
★ COMPLETE UNITS ★

We will gladly work with you in arranging a schedule so that your air conditioning equipment can be taken out and repaired or replaced with a minimum of off-the-road time for the car.

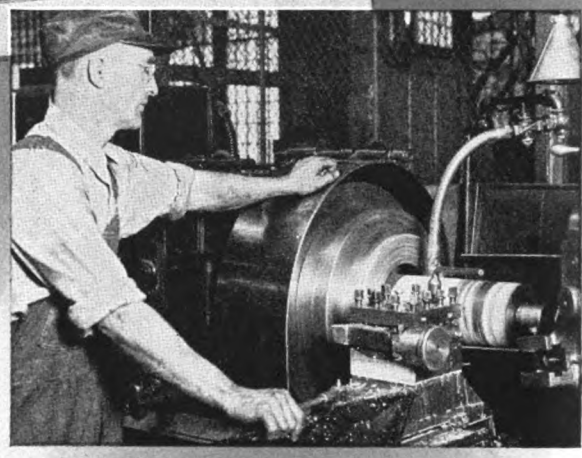
B. F. STURTEVANT COMPANY
Railway Air Conditioning Division
Hyde Park, Boston 36, Mass.

Sturtevant
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Puts Air to Work



A Few Typical Railroad Shop Jobs Produced on Warner & Swasey Turret Lathes

A Small Part Can Play a Big Part in "Keeping 'Em Highballing"



The flexibility of the turret lathe makes it an ideal machine to handle railroad shop jobs. Warner & Swaseys handle hundreds of bar jobs ranging from small cylinder and boiler studs up to the heaviest crank pins; and chucking work, from small brass valves and lubricator parts up to such heavy duty work as cylinder bull rings.

Built-in power, rigidity and accuracy give Warner & Swaseys the ability to do every job well.

Time saving today in railroad repair and maintenance work is more important than ever.

Spring Rigging Pins, Frame Bolts, Guide Bolts, Engine Truck Pins, Crank Pins, Knuckle Pins, Wrist Pins, Throttle Rod Ends, Feedwater Pump Valves, Stoker Parts, Studs, Superheater Details, Bushings, Equalizer Bolts, Lubricator Parts, Oil Cups, Grease Plugs—these are only a few of the many railroad jobs that can be handled at time-saving speed on Warner & Swasey Turret Lathes.

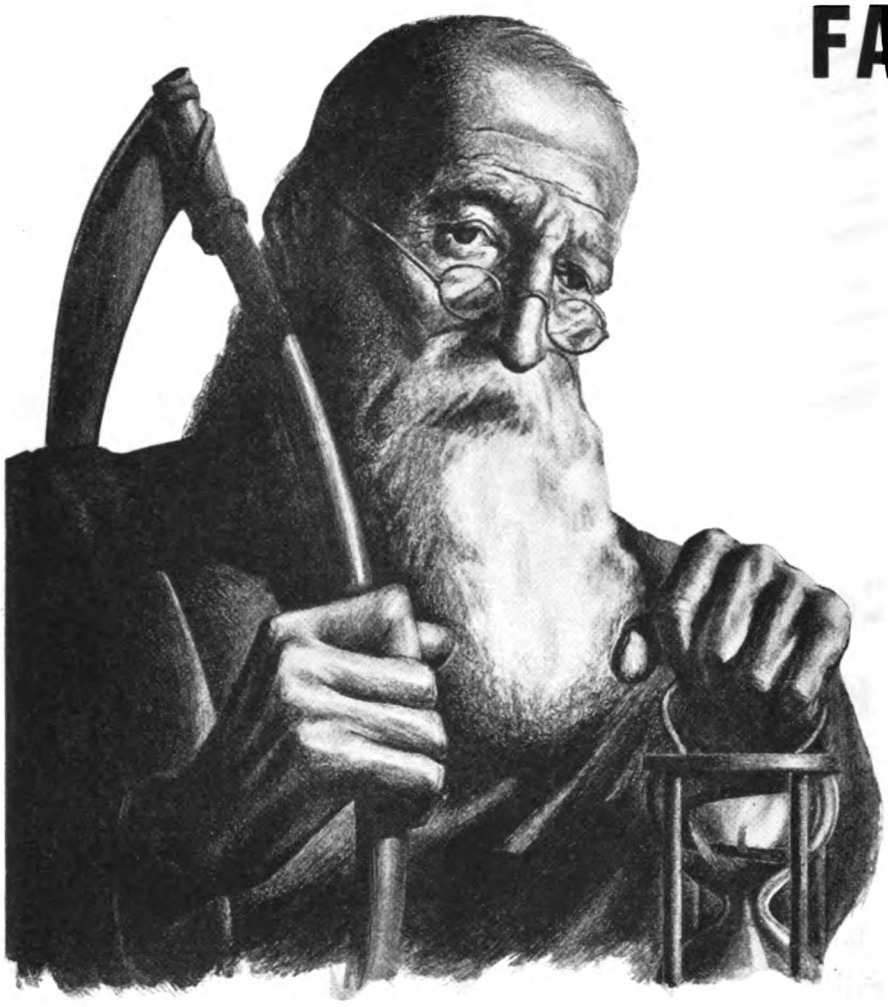
* * *

The advantages of being able to take combined or multiple cuts on so many turning jobs greatly reduce operating time. For example, the action photo above shows a locomotive crank pin being made from 8″ axle stock on a 4A Warner & Swasey with a 45% time saving over former method.

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WARNER & SWASEY
Turret Lathes
Cleveland

LIFE WITH FATHER TIME



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Wyandotte Railway Cleaning Products are trusted standbys. Famed for speed, thoroughness, economy, they get after the hardest oil, grit, grease and carbonized deposits, pull no punches in the toughest back shop work. Remember — whatever your cleaning problem, there's a Wyandotte product tailored for it.

A staunch ally in the railroads' war on deterioration, the Wyandotte Representative is always ready to help you. Call him in—today!

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• Wyandotte Chemicals Corporation consolidates the resources and facilities of Michigan Alkali Company and The J. B. Ford Company to better serve the nation's war and post-war needs

The One Constant Ingredient

Every Railway V-Belt that is made by Dayton Rubber contains one ingredient which never varies. Wartime restrictions can never affect it. It is mixed into every compound of natural or synthetic rubber. It is woven into every inch of fabric, cord or wire destined for Dayton V-Belts.

This constant ingredient is the sum total of Dayton Rubber's 37 years of continuous development, processing and application of rubbers and fabrics of every type. It is the residue of thousands of man-hours of patient research, practical testing and controlled manufacturing ability.

This constant ingredient is the technical knowledge and experience that you would naturally expect to find built into every V-Belt by Dayton, the world's largest maker and pioneer of Railway V-Belts for Car Lighting, Diesel Locomotive and Air-Conditioning Equipment.

So whether the Railway V-Belts you use are made of today's synthetics or tomorrow's "X" materials need not concern you — so long as they bear the name which stands for Technical Excellence over the years.

THE DAYTON RUBBER MFG. CO.
DAYTON 1, OHIO

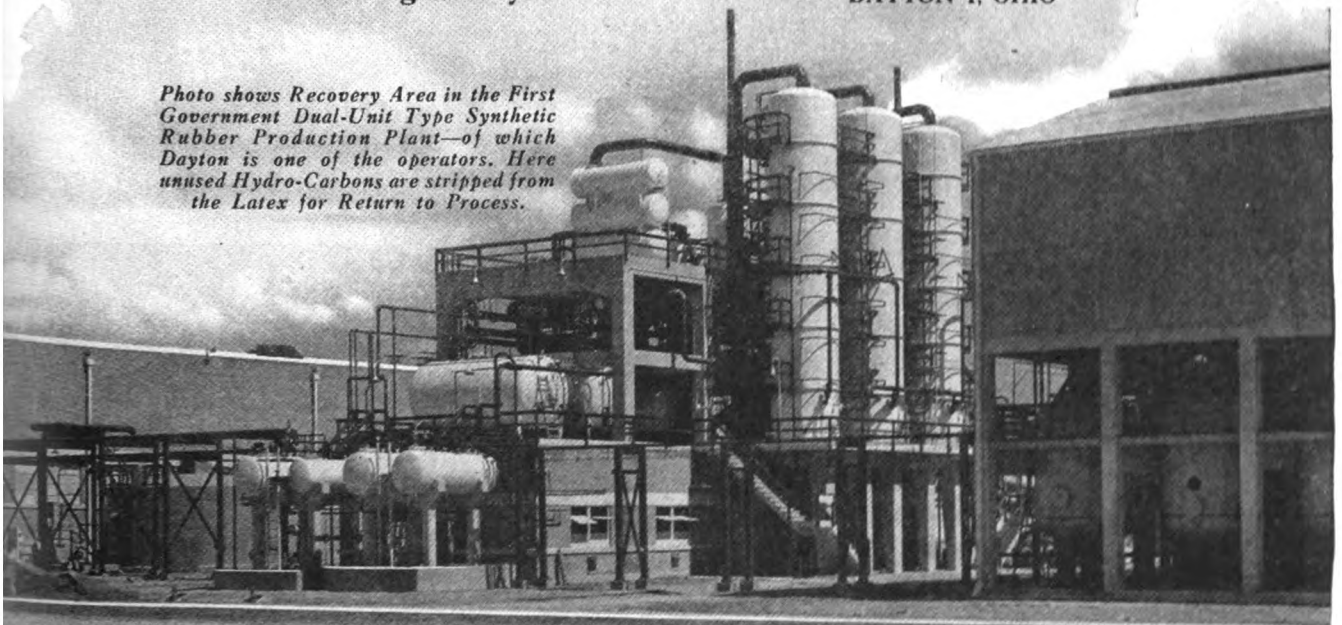
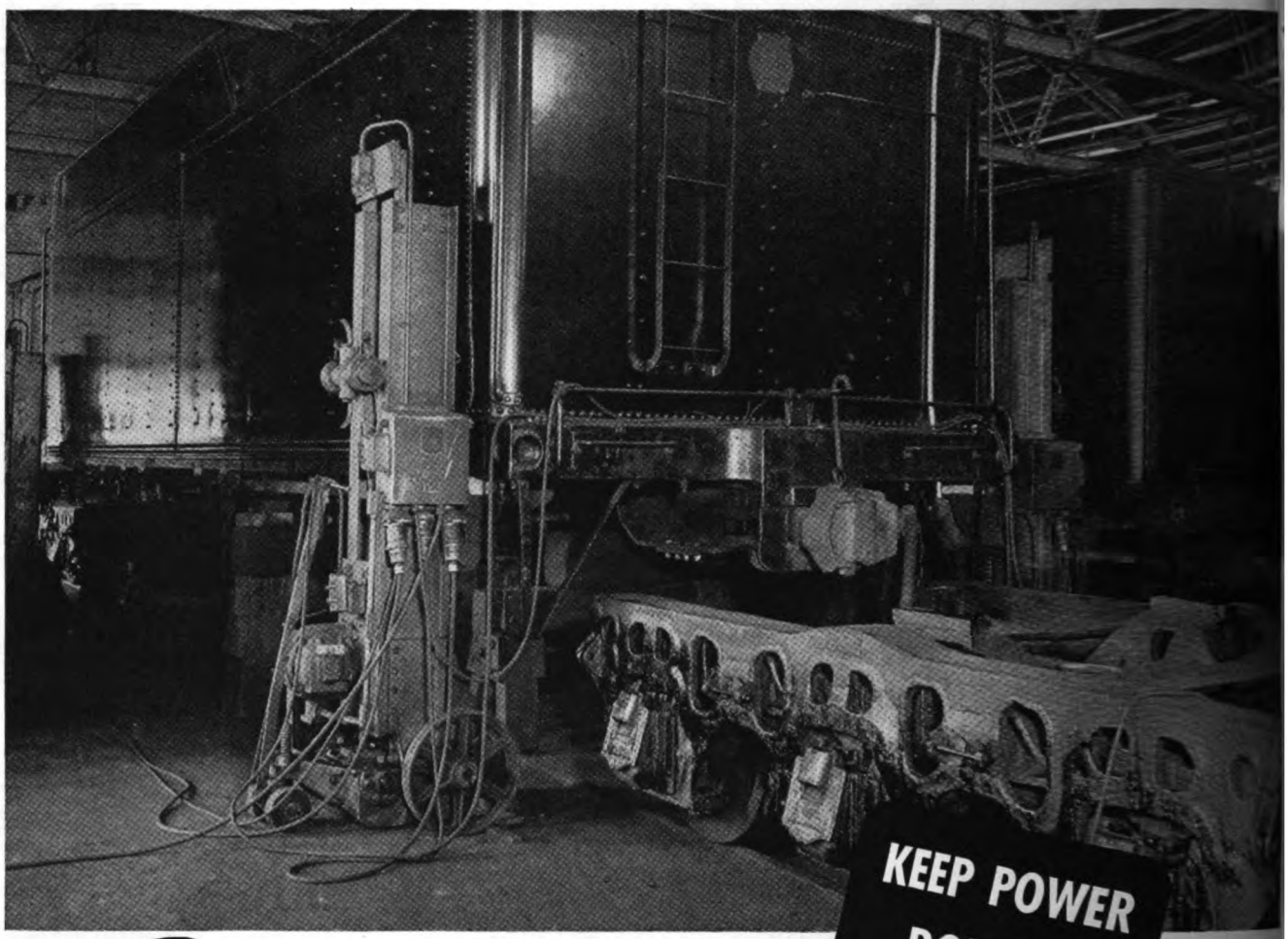


Photo shows Recovery Area in the First Government Dual-Unit Type Synthetic Rubber Production Plant—of which Dayton is one of the operators. Here unused Hydro-Carbons are stripped from the Latex for Return to Process.

V-Belts by Dayton Rubber

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thru the Repair Shop

Give your repair shop a "lift"—with Whiting Electric Portable Jacks. They speed up work in scores of service operations where high lifting helps accessibility. Ideal for removing wheels and trucks, repairing axle-connected generators and motors, and scores of other regular maintenance operations.

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new approved sleeve incorporated into Standard A. A. R. head

CONSERVES MATERIALS

DECREASES BRAKE BEAM FAILURES

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Over 2,500,000 Sleeve Heads in service is evidence of their value

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STOP 'EM BOUNCING
CONSERVE BOLSTER SPRINGS



STYLE A-6-A
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SNUBBER
SPRINGS

The Spring Coil is also the friction shock absorbing element.

Photo by U. S. Army Signal Corps

★ ***Uncle Sam uses VOLUTE Springs on many Tanks!***

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There's no groping and fumbling for the right valve when your locomotive is equipped with a

SELLERS TYPE "S" INJECTOR

A single lever—simple as an automobile handbrake—controls all functions of the injector . . . starting, stopping, regulating capacity and overflow.

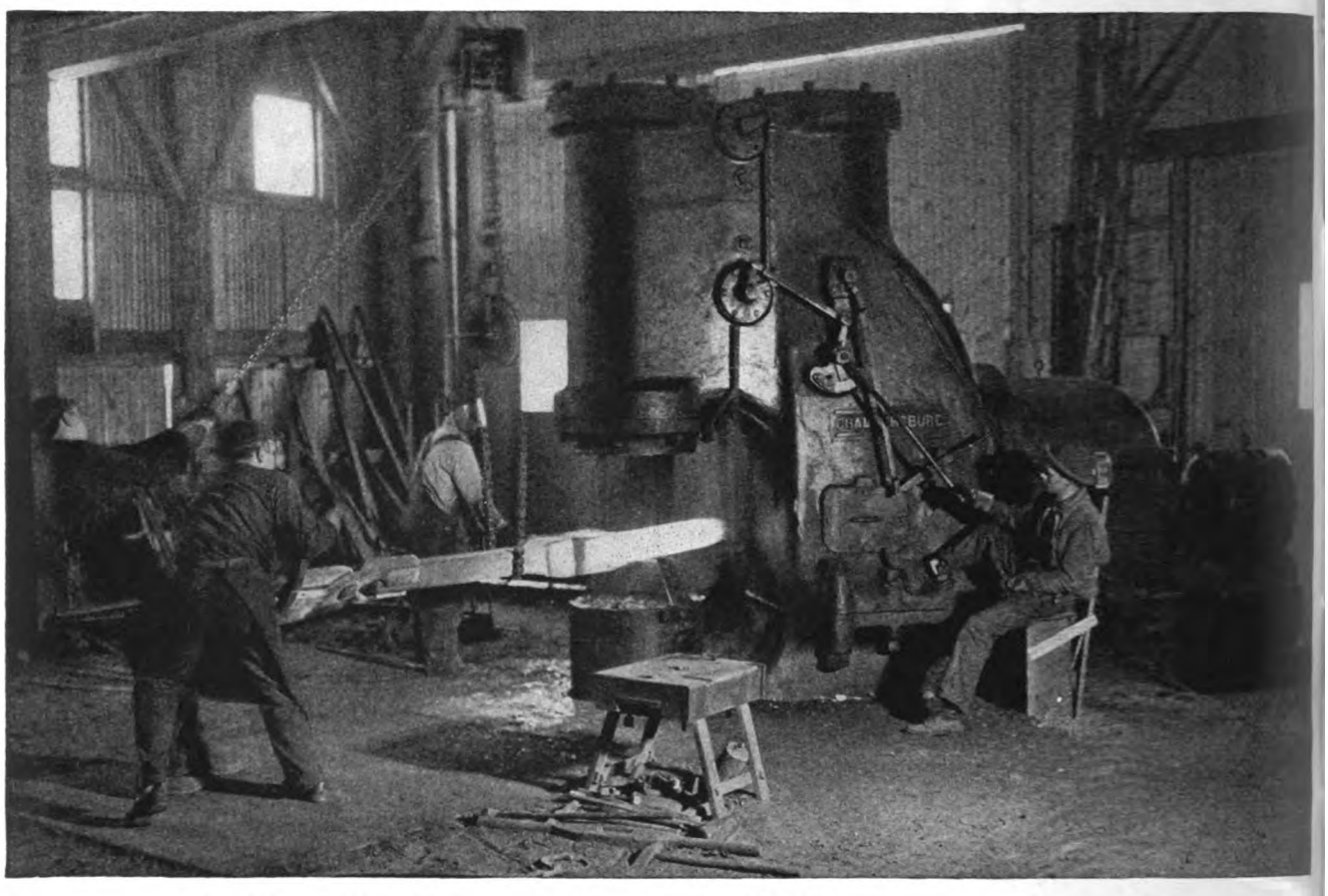
And here are other good reasons why this modern appliance opens a new field in the operation, convenience and safety of locomotive injectors . . . Lowest cost for injector renewals and labor . . . Minimum loss of water when starting and stopping . . . No water hammer or bulging steam lines . . . Located far above the rails, free from roadbed hazards . . . Permits complete drainage of water tank when necessary.

In other words, Sellers has overcome the disadvantages of the old style injectors to such an extent that they are now standard equipment on America's major railroads . . . Glad to send you complete technical information . . . Wm. Sellers & Co., 1630 Hamilton St., Philadelphia.



TYPE "S" INJECTOR

PRECISIONEERING SINCE 1848



A Self-Contained Pneumatic Forging Hammer for Railroad Shops

The Chambersburg Pneumatic Forging Hammer has a greater forging output than any other hammer of its type. More actual forging per blow is accomplished, due to the heavier anvil construction and the higher impact speeds unique with all Chambersburg Hammers. Added to the advantage of more powerful blows is that of greater rapidity of blows, which permits working the forging at higher temperatures.

The Chambersburg Pneumatic Hammer is of the self-contained type, having a compressor piston cylinder and ram cylinder in which a compressor piston and a ram operates. In operation the ram is driven up and down by a flexible air force, created by the compressor piston. The compressor piston is driven by an electric motor of high speed through two stage speed reduction gearing.

The hammer can be started instantly and strikes a constant number of blows heavy or light at the will of the operator. As soon as the motor is up to speed the hammer is ready to operate. "Squeeze" or "hold-down" is provided by a setting of the operating lever latch.

As the compressed air immediately is replaced from the compressor cylinder to the ram cylinder, air of increased temperature, received during the process of compression, is used in operating the ram. This is the most efficient method and almost perfect expansion of air is attained.

Chambersburg Pneumatic Hammers are made in three types:

1. One Piece, having the anvil integral with the frame for installations such as on shipboard and where deep foundations are impractical. Sizes rated at 200 lbs. and 300 lbs. are so constructed.

2. Solid Frame, having separate anvils and a one-piece frame of rigid, reinforced construction. Sizes 300 lbs. and 500 lbs. are of one-piece, or solid frame construction.

3. Two Piece Frame, having separate anvils, and with the frame scientifically and rigidly mounted on a base plate which encircles the anvil. Sizes 750 lbs. and upward are so constructed.

All are constructed with more generous working space than formerly available.

A new bulletin No. 1275 is now available. Write for your copy.

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

ARMY E NAVY

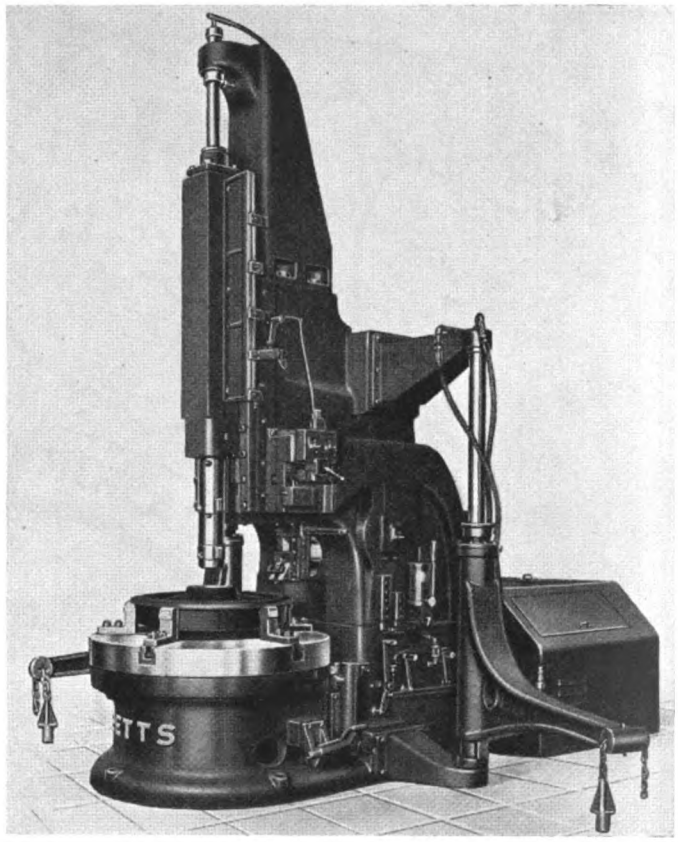
CHAMBERSBURG

HAMMERS · CECOSTAMPS · PRESSES

CONSOLIDATED

WHEEL and AXLE MACHINES

BETTS HYDRAULIC FEED CAR WHEEL BORER



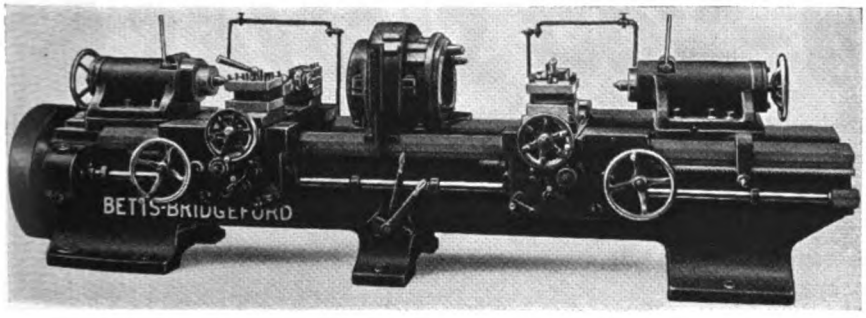
This machine is designed for rough and finish boring and chamfering cast iron and steel car wheels. After wheel is loaded and machine is started, the cycle of operation is automatic including rapid traverse approach, return to starting position and stop.

These machines are turning out work on a production basis in many important railway shops. For further information send for Bulletin 6103.

BETTS-BRIDGEFORD

Heavy Duty Center Drive Axle Lathe

The Axle lathe shown below may be equipped with opposed burnishing arrangement which equalizes the pressure between the front and rear burnishing rollers. It may also be furnished with hardened and ground flat steel ways and carriage bearing surfaces lined with bronze shoes.



When equipped with turret tool holders, the turning and burnishing operations are accomplished by moving rear tool holder out of the way and rotating turret to bring the proper tool into position.

These and other important features make Betts-Bridgeford Heavy Duty Center Drive Axle Lathes highly efficient shop units.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOL CORPORATION

ROCHESTER, NEW YORK



SCRAM-YOU SISSIES!

Harcote's workin' on the railroad now! — licking wear and abrasion wherever they meet! For here's an electrode that means business . . . the business of hard surfacing parts like stoker screws, gears, etc., to keep them on the job.

Protecting softer steels against abrasion and wear is Harcote's way of keeping the rolling stock *rolling*. Easy to work, Harcote goes on smoothly and places a weld that's tough, hard and long lasting. Harcote is used on carbon steel, low alloy and high manganese surfaces. See your P&H representative for information and procedures on this and other P&H Alloy Electrodes. Or write us.

P&H Alloy ELECTRODES

P&H Also Builds a Complete Line of A.C. and D.C. Arc Welders. Write for Literature.

General Offices and Factory:
4607 W. National Ave., Milwaukee 14, Wis.

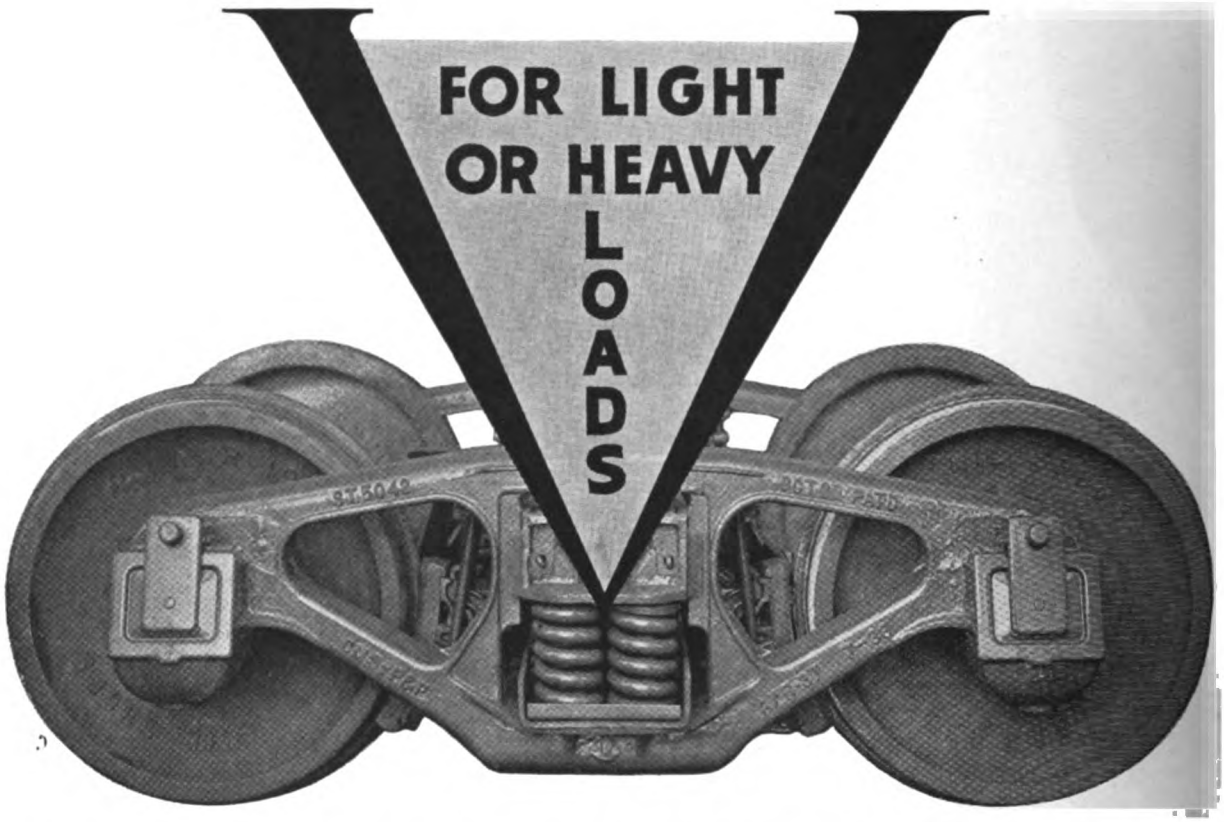
ARMY E NAVY

Another New Star has been Added to P&H's Army-Navy "E."

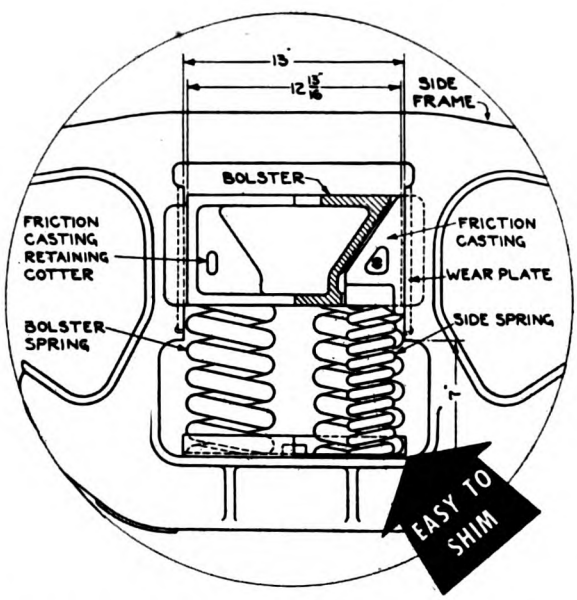
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FIRTHITE
SINTERED CARBIDES
FOR UNIFORM PRECISION
WAR'S "appetite" for interchangeable parts knows no bounds. Since interchangeability depends upon **uniform precision,** tools must **stay** sharp on long runs or long cuts.—That's where FIRTHITE Sintered-Carbide Cutting Tools excel. Their near-diamond hardness maintains **uniform precision** in mass production and on hard materials.
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Offices: McKEESPORT, PA. NEW YORK - HARTFORD - PHILADELPHIA
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BARBER STABILIZED TRUCKS



Over 64,000 Barber Stabilized Car Sets Now Giving Satisfactory Service on 44 Roads and Private Car Lines

Insure Safe, Smooth Riding

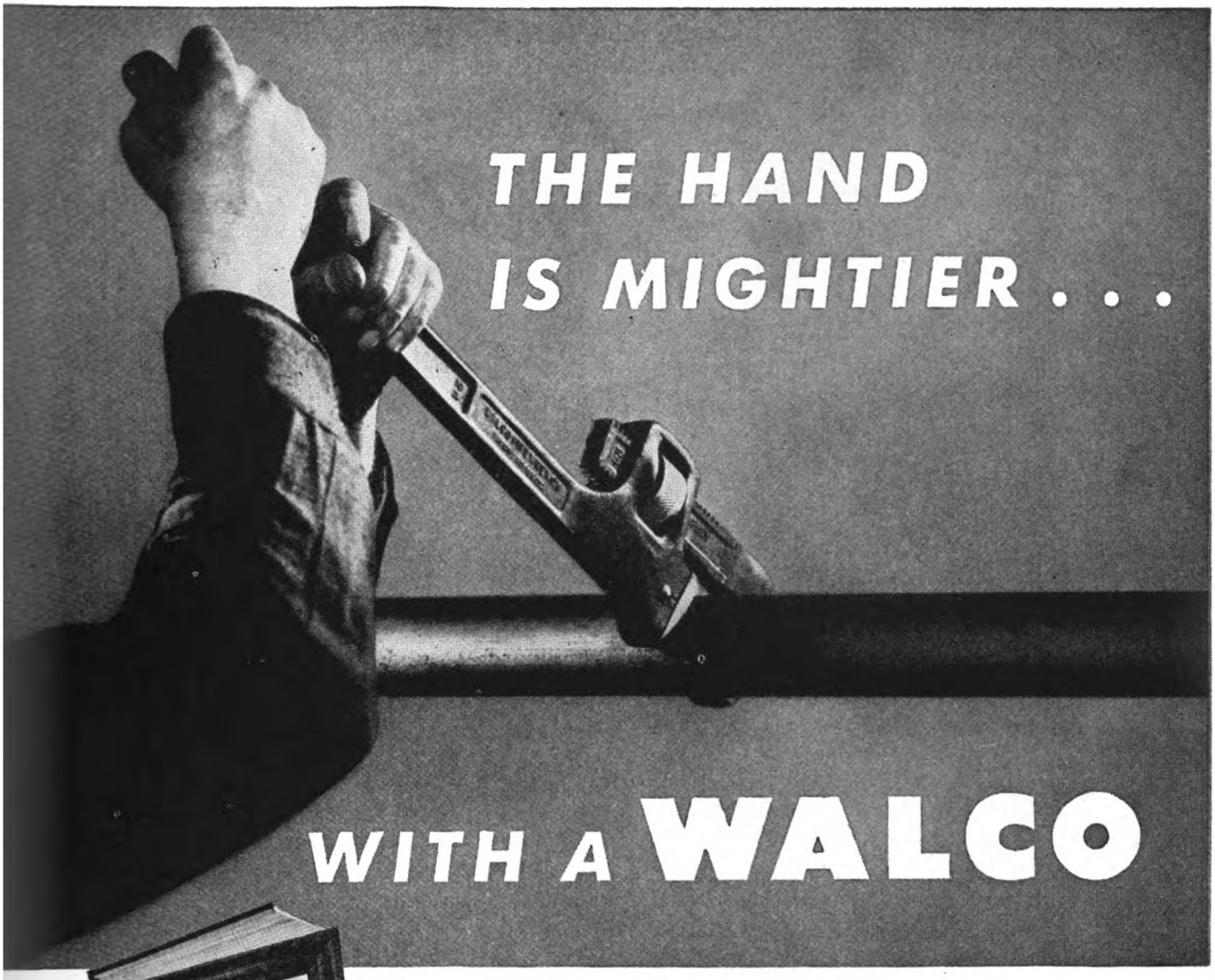
ONE of the outstanding features of Barber Stabilized Trucks is their smooth riding performance, regardless of whether cars are lightly laden or travelling with full load.

Barber Stabilized Trucks prevent excessive compression and recoil of spring nests by means of constant pressure of friction castings against wear plates in the columns of the side frames. As the load on the bolster is applied it forces the friction castings downward on the side springs thereby exerting increasing pressure outward against the hardened steel wear plates, producing just the right amount of damping and shock absorbing action.

The surface ground friction castings have large area contact producing a pressure of less than 20 pounds per square inch with light weight of car body, increasing proportionally with the load to about 80 pounds under normal full load. This low unit pressure promotes long service and gives an action that is soft, certain and highly effective.

Specify Barber Stabilized Parts when ordering trucks for new and rebuilt cars.

STANDARD CAR TRUCK COMPANY
332 SOUTH MICHIGAN AVENUE CHICAGO, ILLINOIS





You'll find pertinent information on Walworth's complete line of valves, fittings, pipe, and pipe wrenches in the new Walworth Catalog 42. Included are 78 pages of practical engineering data that simplify valve selection and make piping layouts easier. Write, on business stationery, for your free copy. Address: Walworth Company, 60 East 42nd Street, New York, N. Y., Department N.

Every part of a Walco wrench is designed and built for strength and safety of operation. The Walco grips and holds no matter how hard you pull. All parts of this modern wrench are **made entirely of steel.** The handle and both jaws are made of drop forged steel. The housing and handle are forged from a single piece of steel. Both jaws are carefully machined, and all parts are heat treated to provide toughness, uniformity, and strength. The cross locked lower insert jaw, which is an exclusive Walco feature, makes it easy to remove a worn lower jaw and insert a new one. The spring may be quickly and easily replaced without the use of tools. These features prolong the life of the wrench indefinitely.

Users everywhere testify to the fact that Walco is the world's strongest wrench, the safest, and by far the least expensive to use. It is made by Walworth Company, manufacturers of valves and fittings for more than a century.

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WALWORTH
valves AND fittings

WALWORTH ★ VALVES AND FITTINGS ★ ESTABLISHED 1842

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



Increase HIS ABILITY

Give Him AIR TOOLS

Every worker has the desire to produce. Give him the proper tools and he'll do it.

Any portable power tool will increase the output of the operator's hands, but a lighter, smaller AIR tool of comparable power will *further* increase his production.

Ingersoll-Rand AIR tools are wanted by men on production lines. Here's why . . . . . .

LIGHT WEIGHT . . . *Air tools are lighter in weight* than other types of portable power tools, and are about *one-half the size.* This is an important factor in reducing operator fatigue.

FLEXIBILITY . . . *Air tools give maximum power immediately.* Starting and stopping are practically instantaneous. This speeds up repetitive operations. *Regulation of power* permits the use of the tools on many kinds of materials and on many types of operations.

DURABILITY . . . *Trouble-free service* is assured by the sturdy construction of AIR tools. AIR motors cannot be damaged by overloading.

POWER . . . *Air tools have more power per pound,* thereby enabling the operator to produce more work with less effort.

SAFETY . . . *Air tools are safe* because they are easy to handle and are simple in design. Compressed air is the safest medium for the transmission of power for portable tools.

Give the man on your production line every possible help! . . . GIVE HIM AIR TOOLS!



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8-350

COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • CONDENSERS • DIESEL ENGINES • CENTRIFUGAL PUMPS

Helping to Keep 'Em Rolling

he splendid record being established by the American Railroads eans that Motive Power is "coming thru" in spectacular fashion. "Falls Hollow" Staybolts are contributing their share to this all-me performance record by furnishing long and carefree service; ith each and every staybolt standing guard to warn of failure ng before the danger point is reached.

"Falls Hollow" Staybolt iron bars can be furnished approximately 16 ft. lengths, offering potentially ny type and length hollow staybolt you may equire — or we can supply you with blank, eaded or finished threaded staybolts eady to apply.



"Make every staybolt Hollow and be SURE"

FALLS HOLLOW STAYBOLT CO.
CUYAHOGA FALLS, OHIO

Speedy, Dependable

Baldwin-Westinghouse

Diesel-Electric Locomotives

Baldwin-Westinghouse Diesel-Electric switching locomotives will help speed car movements through yards and terminals — will help prevent delays on the main lines.

Product of two pioneer companies in the railroad field, Baldwin-Westinghouse diesels are engineered and built for dependability and economy of operation. They are rugged enough to stand up under the most severe operating conditions. Accessibility of equipment facilitates easy inspection and maintenance.

Switching Service



THE BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA

Westinghouse ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH, PA.

Lunkenheimer Valves

Vital Helps to Industry's Needs



Bronze "Renewo"
200-300 lb. S.P.



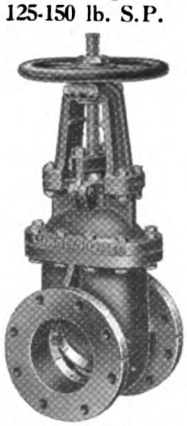
Bronze "N-M-D"
Non-Metallic Disc
150 lb. S.P.



Bronze Gate
Double Wedge Disc
125-150 lb. S.P.



Bronze Gate
Single Wedge Disc
125-300 lb. S.P.



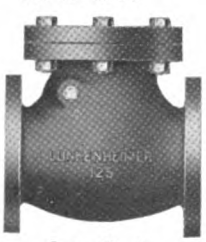
Iron Body Gate
125-250 lb. S.P.



Iron Body
"King-clip" Gate
150 lb. S.P.



Bronze Regrinding
Swing Check
200-300 lb. S.P.



Iron Body
Swing Check
125-250 lb. S.P.

Illustrated are a few of the many types of Lunkenheimer Valves helping to produce vitally needed equipment for the Army, Navy, Maritime Commission, Air Force and Transportation as well as other war agencies.

They're part of the complete line of valves made by Lunkenheimer for every industrial process—of bronze, iron, steel and corrosion-resistant alloys—from tiny needle types to massive power-plant valves—for 125 to 2500 lb. S.P.

A further help is Lunkenheimer's nation-wide distribution through leading supply houses. Wherever there's war activity there's a local Lunkenheimer distributor serving it.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK



Ask for Catalog 78 and the Guide for selecting Valves, Boiler Mountings and Lubricating Devices.



R. R. Blower & Throttle
300 lb. S.P.



A.A.R.
300 lb. S.P.



Bronze Needle Valve
200 lb. S.P.



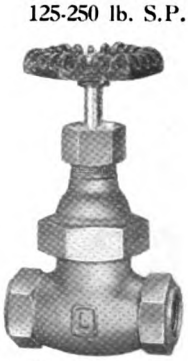
Steel Needle Valve
3000 lb. W.O.G.



Iron Body Globe
125-250 lb. S.P.



Steel Gate
150-2500 lb. S.P.



Steel Globe
Bonnet-Thread-Bushing
600 lb. S.P.

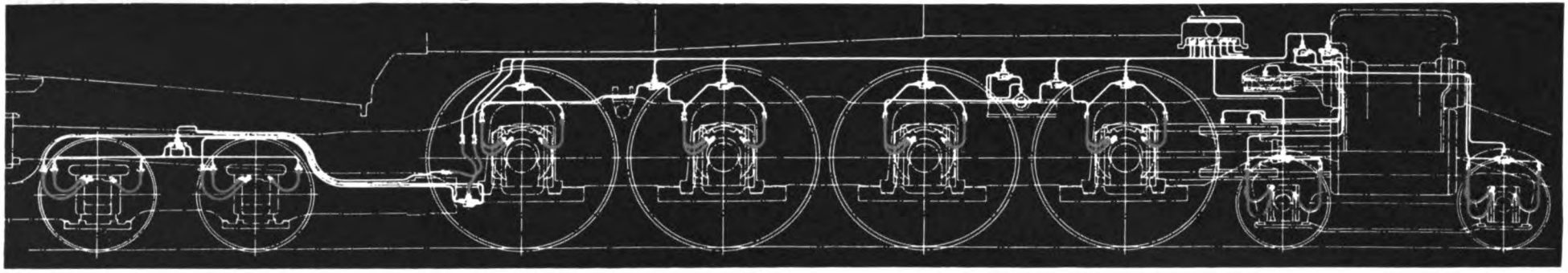


Steel Check
150-2500 lb. S.P.

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S.P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

SPECIFY

Flex-O-Tube High Pressure Hydraulic Hose Assemblies



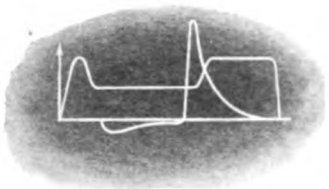
For Efficient Chassis Lubrication

HIGH operating costs due to wear and maintenance of locomotive running gear parts are largely overcome when Flex-O-Tube Hydraulic Hose Assemblies are installed to connect the vital moving parts with the oil distributing system. These Hose Assemblies provide a rugged, weatherproof, flexible tubing, capable of withstanding the high pressure necessary to efficiently lubricate with oils of high viscosity. A typical application is shown above (Courtesy of the Nathan Mfg. Co.) and besides these locations, Flex-O-Tube Assemblies are used for lubricating truck center plates, hinge pins, equalizers, buffers, link trunnions and any other moving part.

FLEX-O-TUBE COMPANY

Detroit — Lafayette and Fourteenth Streets

HELPING TO SOLVE TODAY'S WARTIME PRODUCTION PROBLEMS



the problem of spot-welding heavy gauges

ON ALUMINUM AND LIGHT ALLOYS

It is not generally recognized that the spotwelding of heavy gauge aluminum on a production basis is being successfully accomplished today. While most generally used in the aircraft industry, builders of Railway and Marine equipment will be quick to realize the important advantages of this fabricating method.

Pioneered and developed by Sciaky, the Stored Energy Principle and Variable Pressure Cycle are factors in the successful welding of heavy gauges. The extremely high current requirement is compensated for by the use of Stored Energy, which effects high power factor, uses less current and balances the three-phase supply.

Variable Pressure, another exclusive Sciaky feature, insures spot welds of sound metallurgical quality by ironing out irregularities in the metal, reducing pressure to increase electrical resistance during the flow of current, and finally, "forging" the metal after the weld. The tremendous pressure required is obtained by the use of special heavy duty heads, capable of operating on both Variable and constant pressures. A maximum pressure of 12,000 lbs. is possible.

Write for details. Sciaky experience in the field of Resistance Welding can solve your welding problems, for both the light metals and special steels and armor plate.

★ ★

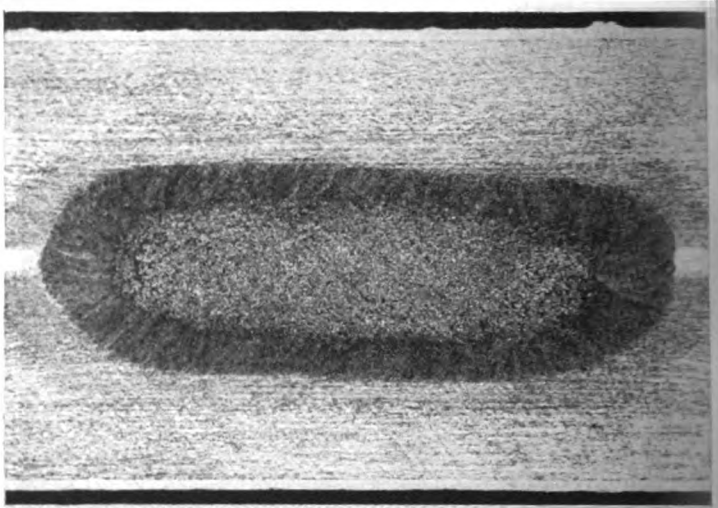


TYPE PMCR2S-5 SCIAKY ELECTRIC RESISTANCE ROCKER ARM WELDER, with built-in rectifier, welding 70 spot welds per minute on two sheets of aluminum alloy of .040" each. Welding capacity: from two thicknesses of .016" in aluminum alloys up to and including .080".

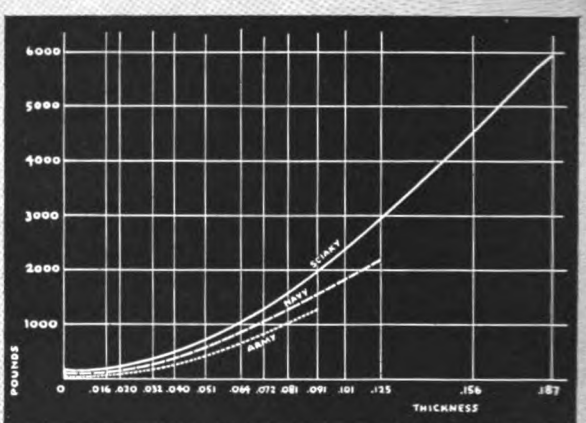
SCIAKY BROS.

Manufacturers of a Complete Line of A.C. and D.C. Electric Resistance Welding Machines.

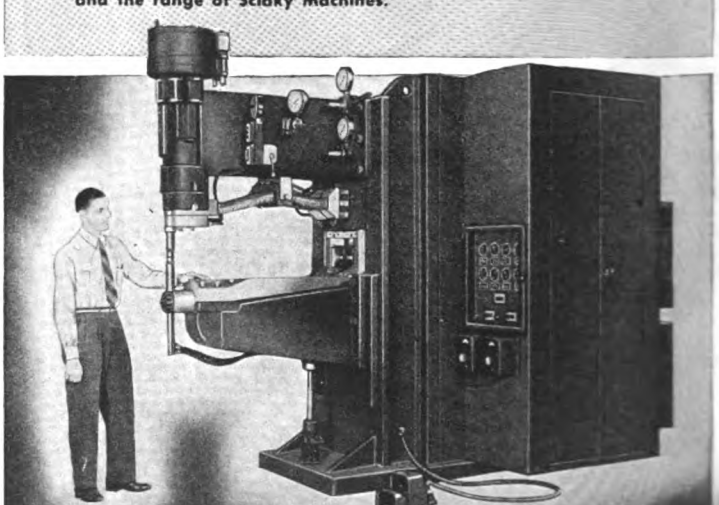
4915 W. 67TH ST. • CHICAGO, ILLINOIS



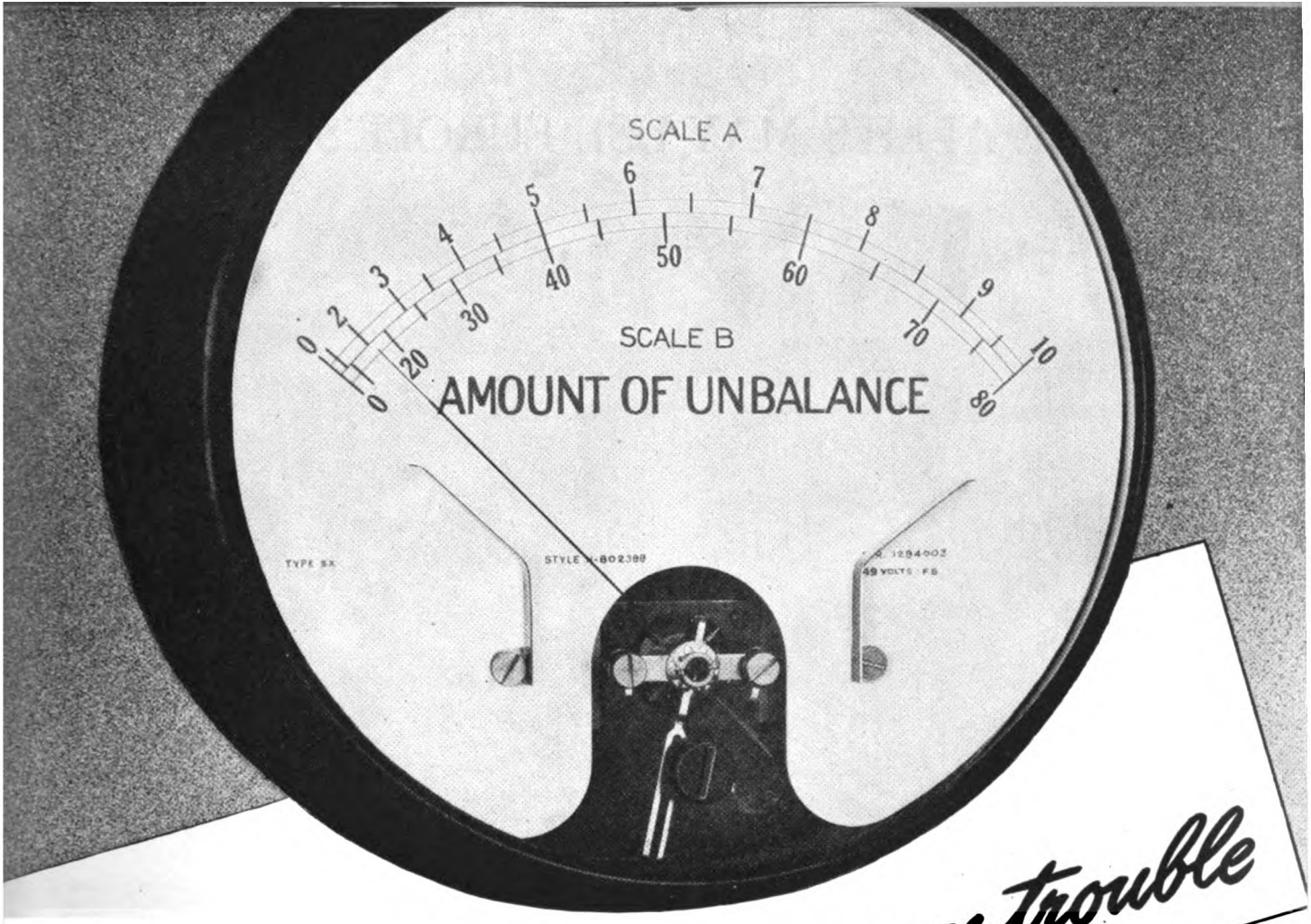
UNRETOUCHED MACROPHOTO of a typical Sciaky spot weld on .156" plus .156", 24ST Alclad at 14X Mg., indicates the weld nugget of proper penetration, and a central zone of uniform cast structure surrounded by an even columnar zone. Good grain structure with no porosity and the absence of cracks is also evident.



A comparison of Army and Navy Minimum Shear Test Values and the range of Sciaky Machines.



TYPE PMC05S-1 SCIAKY ELECTRIC RESISTANCE SPOT WELDER, 240 KW. Welding capacity: aluminum and other alloys or corrosion resisting steels in thicknesses of from .040" plus .040" minimum up to and including .187" plus .187" maximum. Speed: 40 spot welds per minute on two thicknesses of .040" of light alloys.



This hand puts a finger on trouble

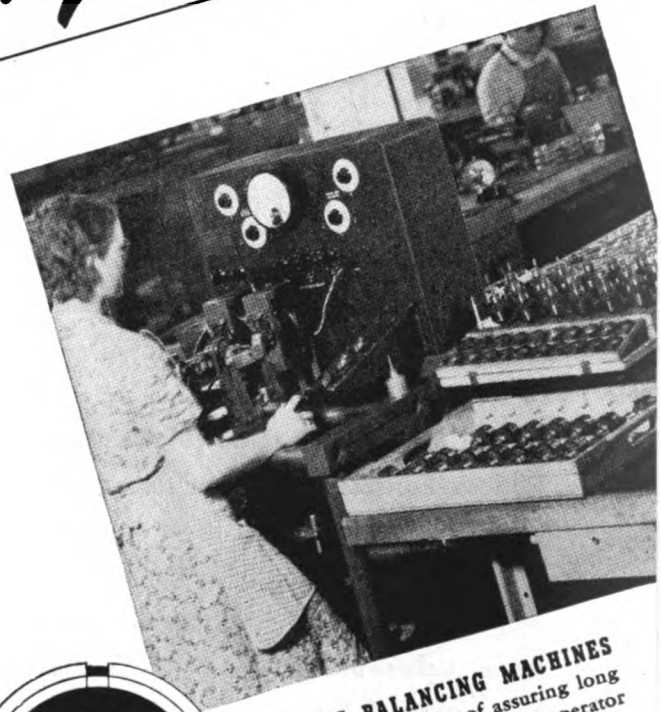
Try to elude this sensitive hand, you gremlins of vibration! You'll be caught—isolated—magnified as much as 1,600,000 times. And your measure will be taken.

The pre-testing of high-speed rotating parts is but a simple meter reading with Gisholt Dynetric Balancing Machines. It's done in a few seconds—the most important seconds in the life of any rotating part. For it is here that unbalanced forces are eliminated to prevent vibration, noise, and excessive wear.

GISHOLT MACHINE COMPANY

1293 East Washington Avenue • Madison, Wisconsin

Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements



DYNETRIC BALANCING MACHINES make a simple routine of assuring long life in this department. The girl operator accurately *locates* and *measures* the unbalance, and *makes the necessary corrections.* Literature on Dynetric Balancing will be sent upon request.

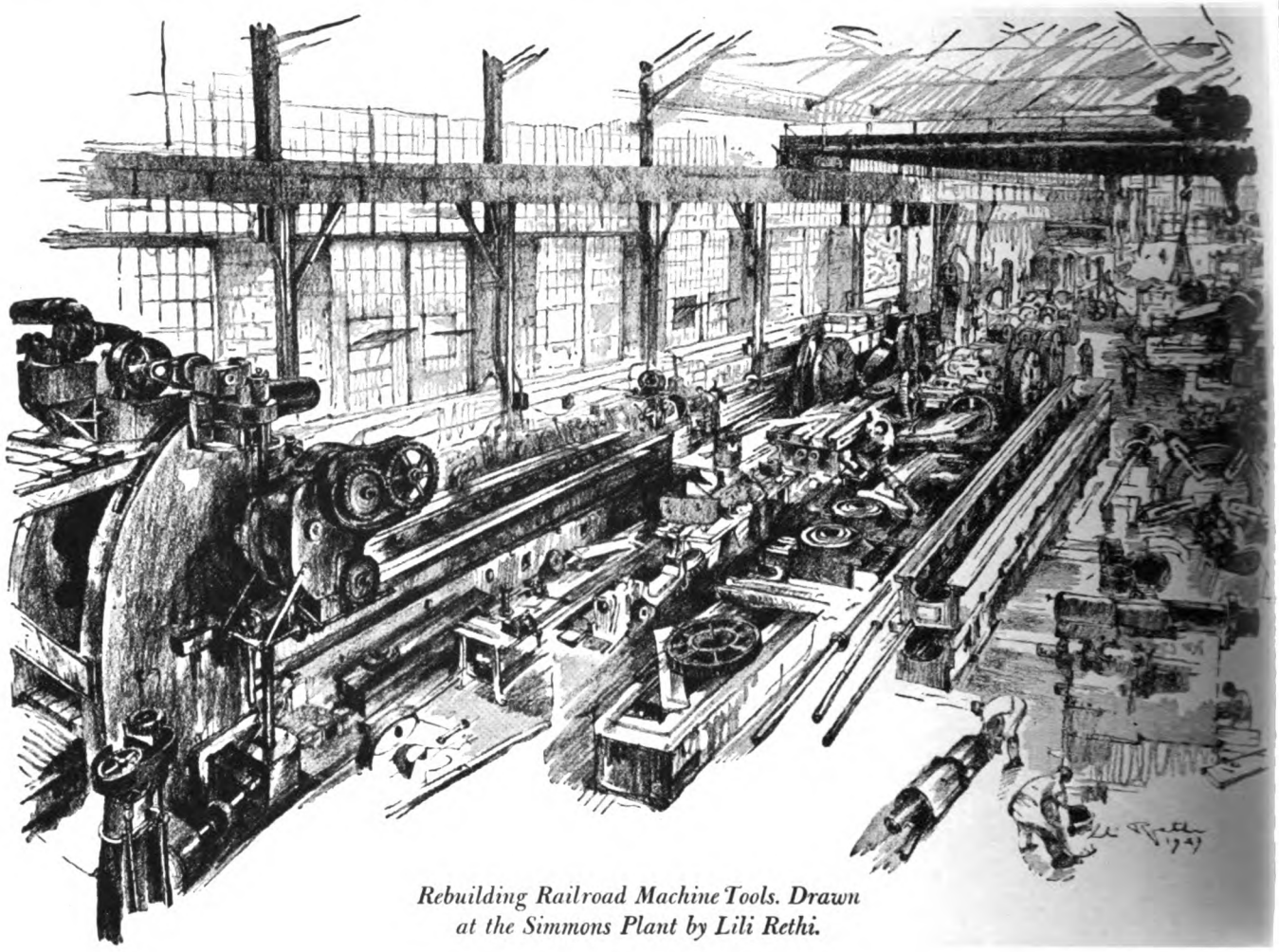
GISHOLT



At Gisholt, the Army-Navy "E" and the Treasury Flag fly side by side

RRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

SO THE ALLIES MAY USE EUROPE'S RAILROADS



Rebuilding Railroad Machine Tools. Drawn at the Simmons Plant by Lili Rethi.

UNENDING TARGET of Allied airmen and underground sympathizers since war's beginning have been the railroads of Europe. To halt the flow of Nazi troops and supplies, terminals, freight trains and railroad shops have been bombed, dynamited and wrecked at every opportunity.

Because these same railroads are equally vital to the Allies as supply lines for the penetration of Hitler's Fortress, equipment for restoring them to operating condition is high on the vast list of materiel carried by invasion barges and ships. This means all types of heavy machine tools—railroad wheel lathes, planers, boring mills, among others.

Every available machine tool suitable for this purpose is being unearthed. Inasmuch as our own railroads, handling the heaviest transportation loads in their history, require similar equipment in great amounts, many of the machine tools acquired for the invasion of Europe were old and rundown. *Engineered Rebuilding* by Simmons, however, restored them to good operating condition.

Here, then, is just one example from many illustrating the complex nature of this Global War, the seemingly unending requirements. Thousands of miles behind the battle lines the materiel must be planned down to the last detail.

SIMMONS MACHINE TOOL CORPORATION
1825 North Broadway, Albany 1, N. Y.

SIMMONS *Engineered* REBUILDING

The Extra Men You Need ARE ON THE JOB . . .



and the Simplest Fastening Method will help you find them

When you cut the man-hours required on fastening jobs by one-third or more, you'll have men available for other work – men you badly need to meet today's "hurry-up" schedules for car building and repairs.

Savings of 25 to 50 percent of fastening time are commonplace when P-K Self-tapping Screws replace other fastening methods. There's no simpler way to make fastenings – just drill or punch holes, and drive in Self-tapping Screws. You eliminate the tapping and tap maintenance needed for machine screws. You avoid the slow nut-running needed for bolts. You save much of the time lost welding or riveting in hard-to-reach places. And fastenings made with P-K Self-tapping Screws are usually *stronger!*

Change to Self-tapping Screws Overnight. No special tools or skilled help are required. Whether you're working with light or heavy steel, cast iron, aluminum, brass, or plastics, there's a P-K Self-tapping Screw for the job.

Call in a P-K Assembly Engineer. He can help you with your fastening problems. And, remember, he recommends P-K Self-tapping Screws only when they will do the job better, in less time, at lower cost. If you prefer, mail a brief description of fastenings for recommendations. Parker-Kalon Corp., 194-198 Varick St., New York 14, N. Y.



SELF-TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY

PARKER-KALON

Quality-Controlled

SELF-TAPPING SCREWS

Give the Green Light to War Assemblies



Flexibility

IS NECESSARY IN A MAINTENANCE SHOP

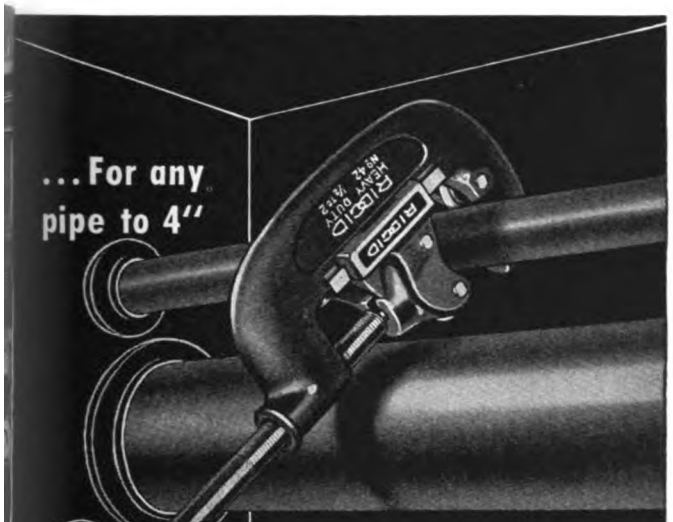
In the maintenance shops of the Grand Trunk Railroad at Battle Creek, Michigan, a Type HD-247218-A Box Furnace, as shown, is used for the critical drawing of engine springs and other parts. Other Hevi Duty furnaces are used for carburizing, hardening and subsequent heat treating. The flexibility and accuracy of these furnaces have done much to keep rolling stock maintenance at a low cost.

SEND FOR BULLETINS HD 341 and 441

HEVI DUTY ELECTRIC COMPANY

HEAT TREATING FURNACES HEVI DUTY ELECTRIC EXCLUSIVELY

MILWAUKEE, WISCONSIN



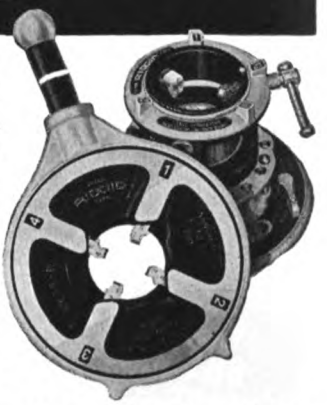
New Type RIDGID CUTTER with 4 cutting wheels



Cuts pipe if there's room for a quarter turn.

WHEN you have pipe to cut in close quarters, in a trench, near a wall or other pipes it's easier with this new RIDGID Heavy-Duty Cutter. The handle is short; and you use *four* heavy-duty cutting wheels *that roll right through pipe* up to 4" with a minimum of burr. The tough malleable frame holds perfect alignment, always cuts true. Comes in two sizes — No. 42, and No. 44. For tight-spot pipe cutting . . . ask your Supply House for the *new* RIDGIDs.





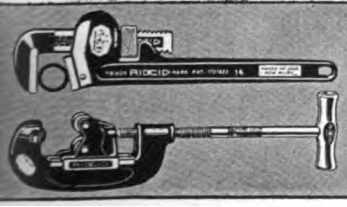
YOU set it to thread 1", 1¼", 1½" or 2" pipe by a simple 10 second adjustment. You set the mistake-proof workholder to pipe size by an instant turn of the gauge ring, tighten only one screw — no bushings needed. It's almost automatic. No extra chaser dies to carry around — one high-speed steel set stays in the die stock, cuts micrometer perfect threads on all four sizes of pipe with easy ratcheted strokes. Steel and malleable durability. For smooth speedy and easy threading . . . ask your Supply House for this self-contained RIDGID No. 65R.

Buy RIDGID Pipe Tools at Supply Houses Everywhere

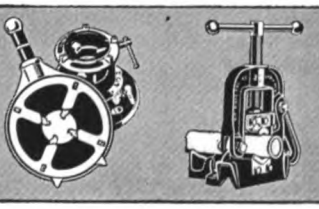
RIDGID

★ PIPE TOOLS ★

THE RIDGE TOOL COMPANY
ELYRIA, OHIO, U.S.A.



Fast-Working Tools for War . . . and the Busy Peace that's Coming



The IRON HORSE



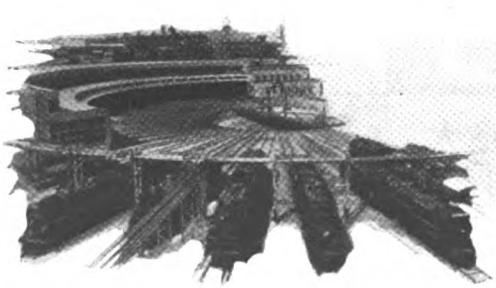
Must not fail

The burden put upon railroads to transport troops and materials to strategic centers has taxed the endurance of motive power and rolling stock. Locomotives must be in service almost continuously. Time out for repairs must be held down. Babcock & Wilcox Boiler Tubes help keep locomotives on the road, reducing the time and labor costs of repair. B&W Tubes can be used for many mechanical repair jobs in the roundhouse machine shop. Many parts hitherto requiring intricate machining processing, can now be produced from tubing at considerable saving in time and money.

Seamless: B&W Seamless Tubing is made in a complete range of carbon and alloy steels in sizes from 1/2 to 8 5/8 in., O.D.

Welded: B&W Electric Resistance Welded Tubing is produced in carbon grades in sizes ranging from 3/4 in. to 4 in., O.D.

★ BUY MORE WAR BONDS! ★



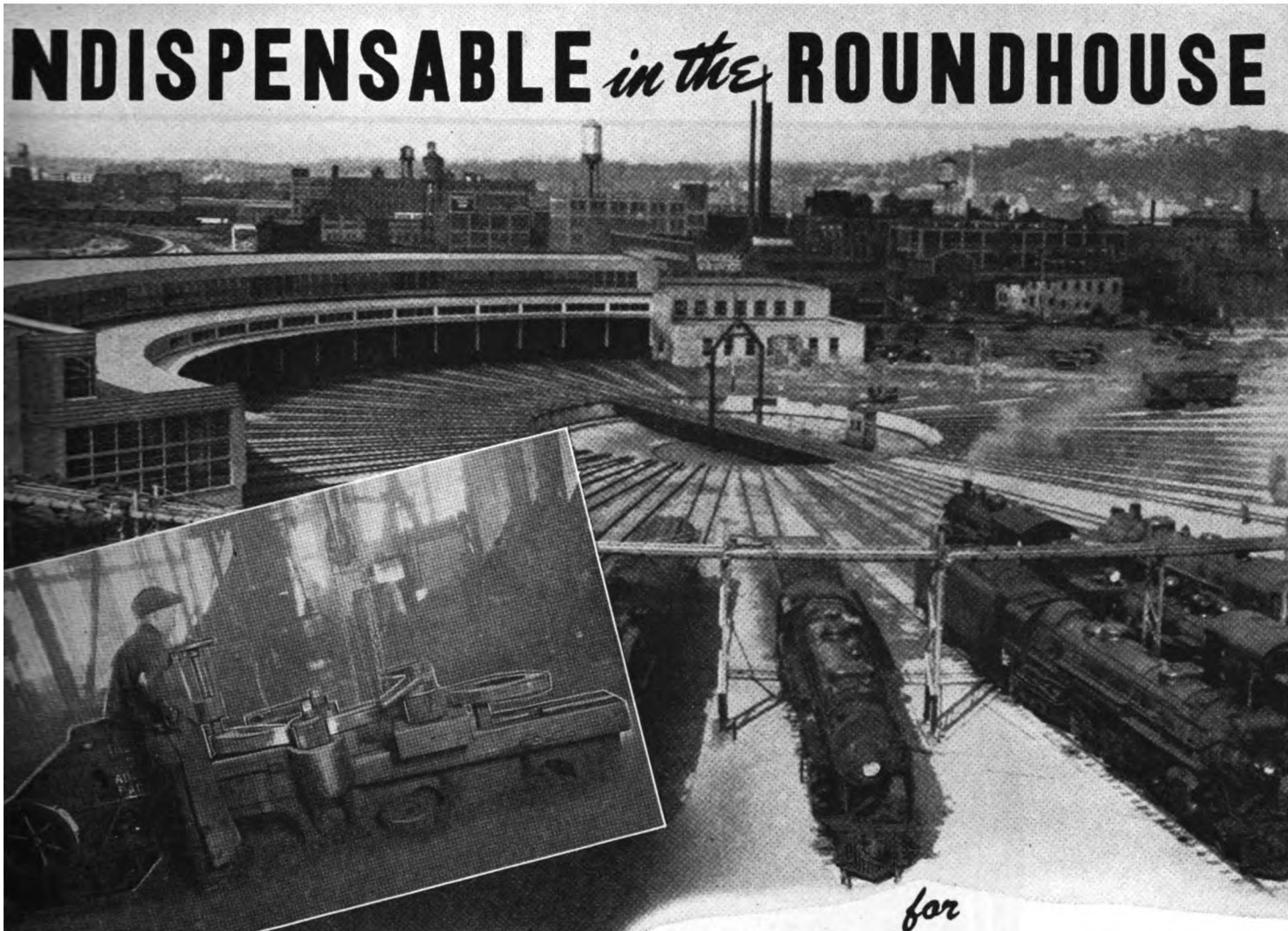
THE BABCOCK & WILCOX TUBE CO.

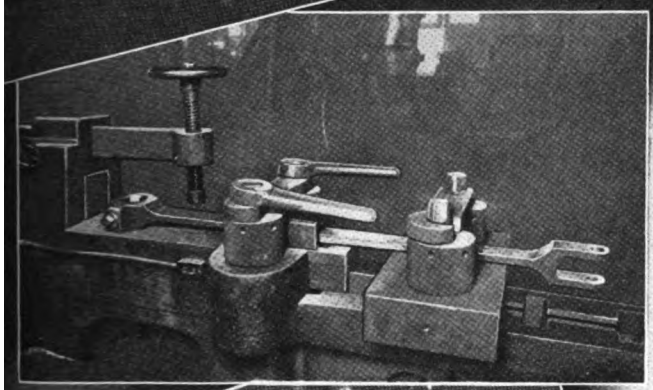
SEAMLESS TUBE DIVISION • *WELDED TUBE DIVISION*

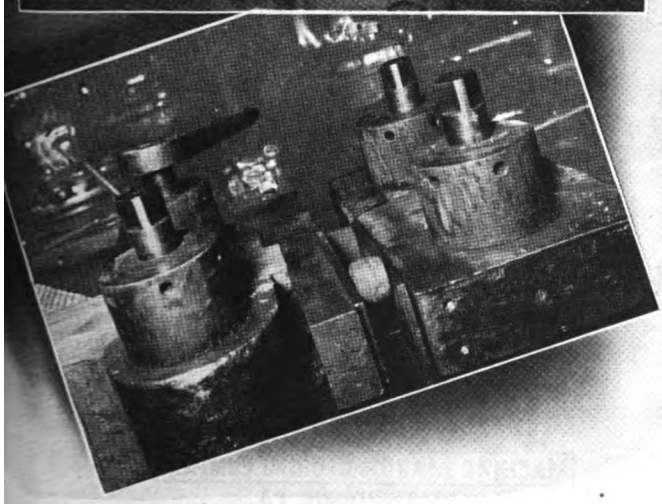
BEAVER FALLS, PA. **ALLIANCE, OHIO**

TA-1273

INDISPENSABLE *in the* ROUNDHOUSE







The Walter Stock Adjusting Machine in operation: (A) lengthening an eccentric rod and (B) straightening a guide. Full details and specifications for this machine are included in Bulletin B-24. Send for a copy.

for

LENGTHENING, SHORTENING, STRAIGHTENING

LOCOMOTIVE PARTS

Railroads are taxed to capacity with war-emergency travel and freight movement, so the job of keeping rolling stock in shape has assumed gigantic proportions. The Walter Stock Adjusting Machine, manufactured by Watson-Stillman, can do many of the repair jobs formerly done manually—a long and not too accurate method.

In a shortening operation, one end of the piece is held by cams, the other end in contact with the ram, the heated portion in between. The pressure against the end upsets the heated area. In lengthening a piece, one end is held by cams in the frame, the other by the cams in the sliding block, with the heated portion in between. As the sliding block is pushed, the piece will be stretched and lengthened. For ordinary straightening jobs the work is placed crosswise the machine. As the ram moves forward the piece is pressed against the sliding block and straightened. All of these operations produce an accurately finished job, free from hammer marks, die marks or thin spots often left when such work is done under steam hammer.

Four types are available — Hydraulic Jack, Accumulator, Compressed Air and Motor-Driven Pump. The Watson-Stillman Co., Roselle, N. J.

WATSON-STILLMAN

Hydraulic Equipment. Valves. Forged Steel Fittings

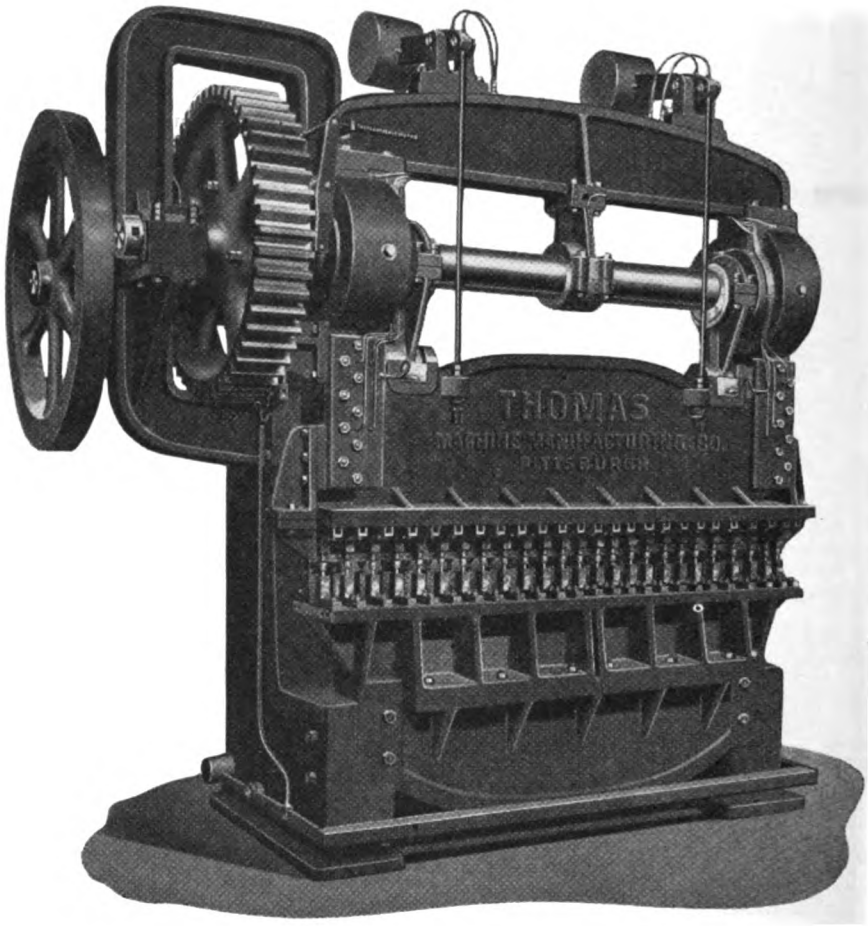


BUY BONDS FOR BIGGER BOMBS

THOMAS

Multiple Punches

For Railroad Car Shops



This 600 ton Multiple Punch was built by Thomas for one of our leading railroad systems.

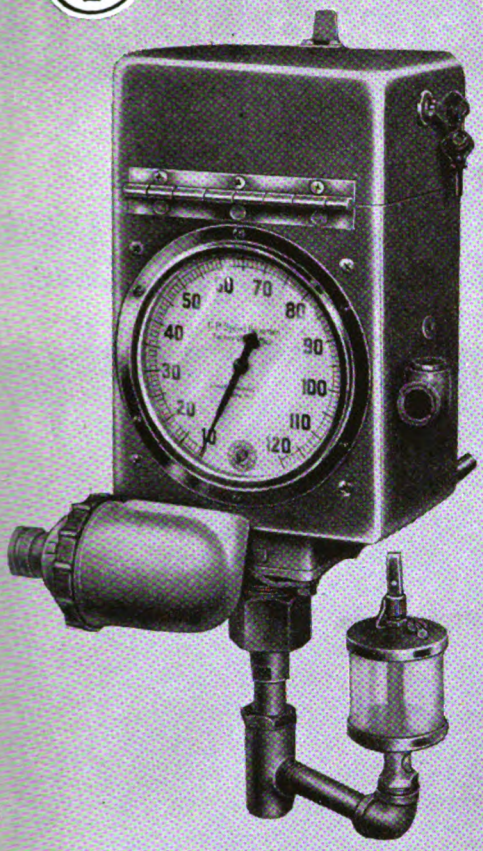
Thomas can build equipment for the forge shop or car shop to meet your specific requirements.

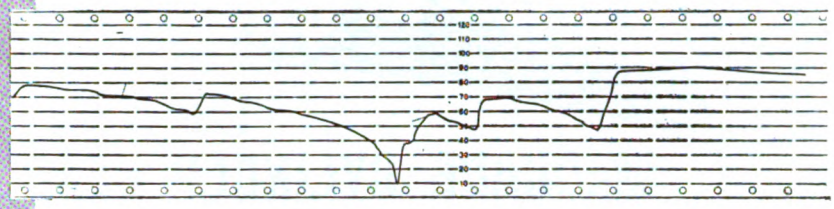
●

THOMAS
MACHINE MANUFACTURING COMPANY
PITTSBURGH, PA.

SPACING TABLES • DUPLIKATORS • PUNCHES • SHEARS

RAILWAY SPEED RECORDERS





Provide a Running Record

— Running Speed and Distance Traveled
— Acceleration
-- Deceleration
— Forward and Backward Movement
— Slippage

Two Models: CP High Speed Recorder, shows and records all speeds from 10 to 120 miles per hour.

CP Low Speed Recorder, identical in construction with High Speed model, but indicates and records speeds from 0 to 75 miles per hour.

Both models furnished in friction drive for steam locomotives or angle drive for Diesel locomotives.

Write for Bulletin 841 covering CP Railway Speed Recorders and CP Railway Speed Indicators.



For service where permanent record or performance charts are not required, there are two models of CP Railway Speed Indicators, identical in construction with CP Speed Recorder, but without recording chart.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

Faster Get Wartime Speed on Resurfacing Jobs!

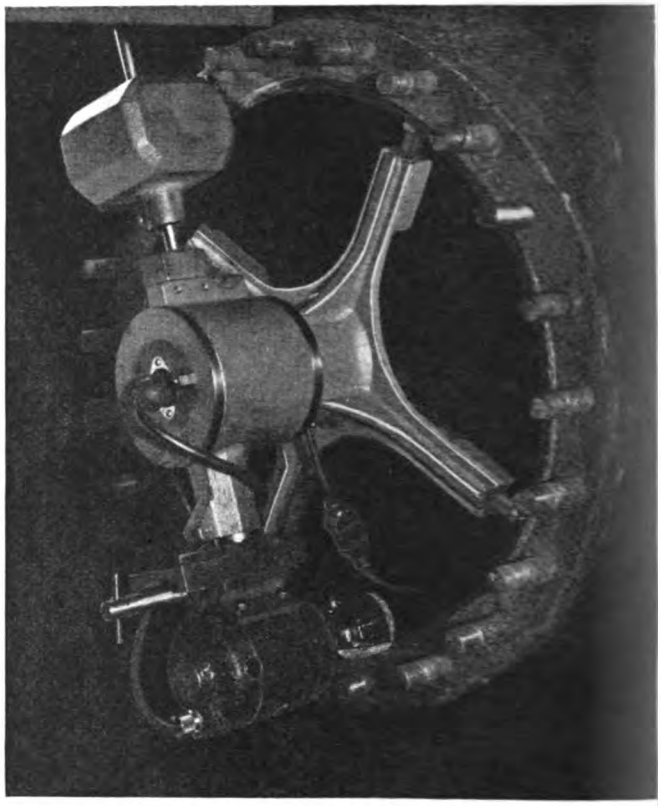
the NEW McQUADE CYLINDER HEAD SEAT GRINDER

Does 6 Hours' Work in ONE

Locomotives were never worked harder than today. Never had it been more important to get them back quickly from the shop into active service. And the New McQuade Cylinder Head Seat Grinder is certainly doing its share in speeding resurfacing jobs.

One major road, operating 23 McQuade Grinders reports time savings of as high as 83%, owing to the Grinder's speed, ease of operation and precision accuracy which assures a steam-tight, trouble-free joint.

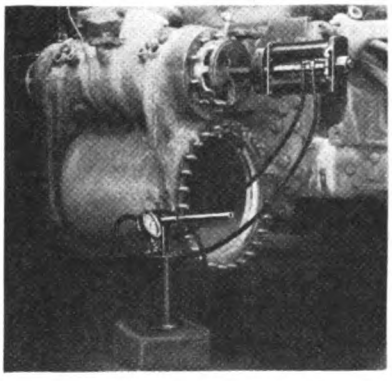
The Grinder works on an entirely modern principle . . . studs need not be removed . . . it is adjustable for varying cylinder diameters and for light or heavy cuts. Furnished with ½ HP. Universal Motor.



Furnished with ½ HP. Universal Motor

15 Minute—Hydraulic Valve and Cylinder BUSHING APPLICATOR

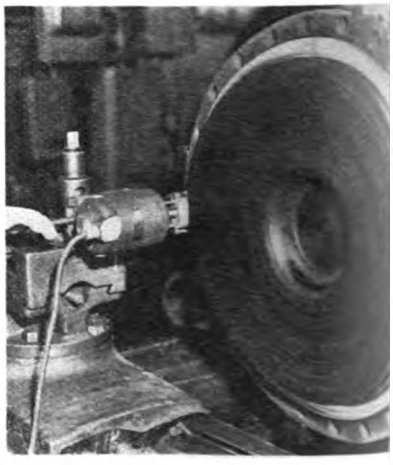
For Locomotive Valve and Cylinder Bushings



Portable, compact, lightweight, easily set up and operated by one man, it eliminates the need for compressed air, air motors and crane for handling power wrench. Can also be used for applying rod bushings, driving-box brasses and other similar operations.

Electric Tool Post Grinder

This companion tool to the Grinder is designed for speedy precision resurfacing of seats on Cylinder Heads. Serves as both lathe and boring mill and is furnished with cup-type grinding wheel. Independent cross-feed slide for adjusting grinding wheel to seat surface.



Ask Today For Full Particulars

R. J. McQUADE COMPANY
7734 South Phillips Ave., Chicago, Ill.

Reciprocating

Hy-Draulic

Machine Tools

To Help You Keep 'Em Rolling

You can depend upon Hy-Draulic Shapers, Planers, Slotters and Shaper-Planers for important help in the war-winning job of keeping railway rolling-stock rolling. These machines . . . and these *only,* in their classifications . . . have hydraulic drives that provide unlimited numbers of cutting speeds and feeds, in specified ranges. Quickly, easily and without stopping the machines, operators can get the exact combination of cutting speed and feed for best results on work in process. They can reverse or "short-stroke" rams or tables at any point. Centralized controls and power rapid traverses promote easy set-up and high output.

Through years of serving railway shops, the manufacturers of Hy-Draulic Machine Tools developed standard chucks, heads and fixtures especially suitable for various operations in the manufacture and maintenance of locomotives and other equipment. Complete information about these, and suggestions for special handling of current work, will be supplied promptly on request.

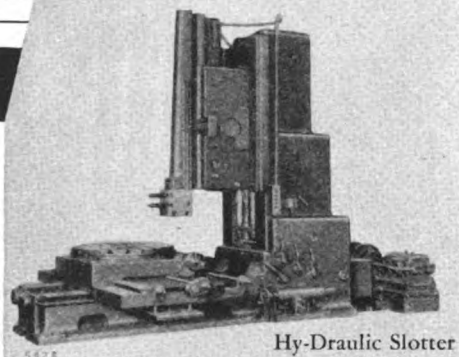
Hy-Draulic Machine Tools are illustrated, described and specified in Catalog No. 1901. Write for your copy, *today.*

BUY UNITED STATES WAR BONDS AND STAMPS

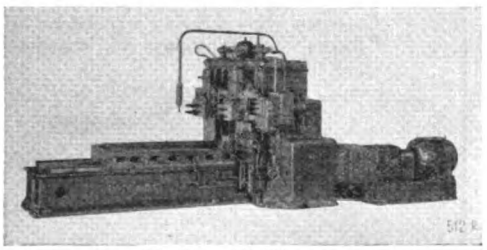
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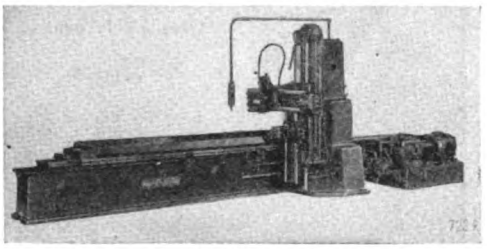
Hy-Draulic Slotter
12" Stroke



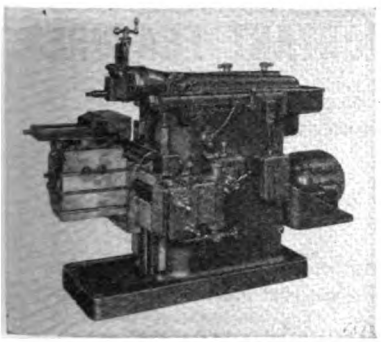
Hy-Draulic Slotter
36" Stroke



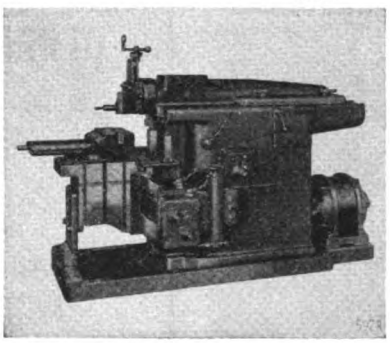
Hy-Draulic Planers
Double-Housing shown, Openside available



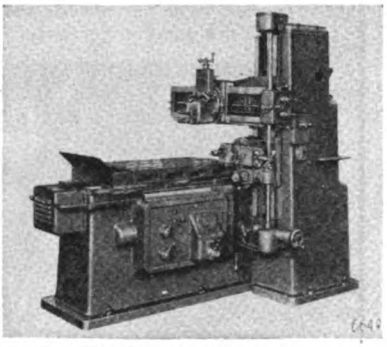
Hy-Draulic Shaper-Planers
66" to 144" stroke



Hy-Draulic Shaper
12" High Speed



Hy-Draulic Shapers
16" to 28" stroke



Hy-Draulic Shaper
36" Openside

Hy-Draulic
Reg. U. S. Pat. Off.

Shapers..Planers..Slotters..Shaper-Planers

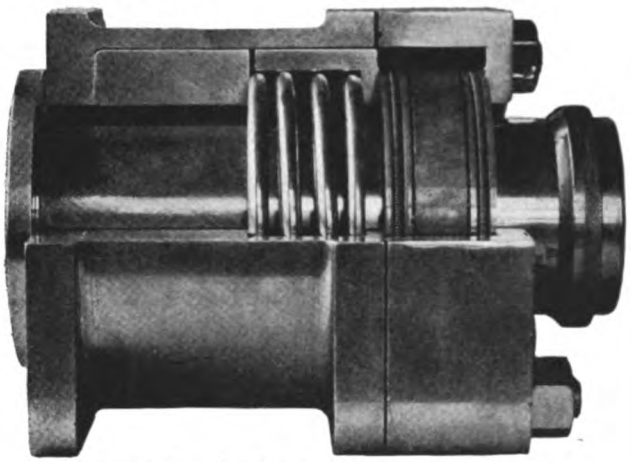
ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS, U.S.A.

Cut Packing Costs in Half

Meets I. C. C. regulations regarding freedom from steam-leaks, which might obscure engineman's vision.

Saves on Fuel **Less Rod Wear**



Cut-away view showing installation of Ace Everseal Packing in stuffing box of locomotive piston rod



PACKING WEARS EVENLY

Uniform wear prevents scoring and making the rod egg-shaped. In no instance has wear by Ace Everseal Packing made rod grinding necessary.

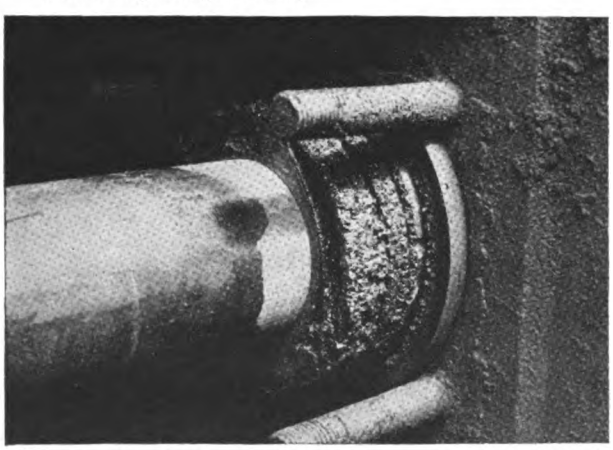


Illustration showing how spring pressure causes Ace Everseal Packing to maintain steam-tight condition continuing to grip the piston rod tightly in spite of wear



The NEW ACE EVERSEAL MECHANICAL METALLIC PACKING

The NEW ACE EVERSEAL Mechanical Metallic PACKING is the result of more than fifty years of packing experience, research and exhaustive practical tests in regular locomotive service. Ace Everseal Packing is designed for either superheated or saturated-steam locomotives.

Combined Bronze and Cast Iron Construction Assures Unusual Wearing Quality

After seven years of intensive experimentation with either cast iron or bronze packing we discovered that a combination of the two in a six-segment packing assured service life double, or even treble that of either packing alone.

OTHER IMPORTANT FEATURES

- Designed to exert equal pressure on rod whether steam pressure is 10 lbs. or 500 lbs.
- Packing is interchangeable with all other packing.
- All six sections held in position and constant pressure on rod maintained by steel springs.
- Write for Full Particulars TODAY!

BADEKER MANUFACTURING COMPANY

Manufacturers of

ACE EVERSEAL METALLIC PACKING

408-416 So. Hayne Ave. **Chicago, Ill.**

AJAX FORGING MACHINES AND FORGING PRESSES WITH DIRECT-ACTING AIR CLUTCH

Provide

- ★ **INSTANTANEOUS ACTION** due to quick clutching
- ★ **FASTER OPERATION** more machine strokes per minute
- ★ **LESS OPERATOR FATIGUE**
- ★ **LESS DOWN TIME** due to cushioned starting
- ★ **HIGHER PRODUCTION**
- ★ **LOWER PRODUCTION COSTS**



Ajax High Speed Forging Press Bulletin No. 75

Ajax Upsetting Forging Machine Bulletin No. 65-B

THE **AJAX** MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND, OHIO

621 MARQUETTE BUILDING • CHICAGO, ILLINOIS

10 STAR ITEMS

from the Complete Line of

OLIVER

SPECIALIZED R R FASTENERS



WATERTIGHT BOLT
Weather-sealed, heavy flush head. No counter-boring needed. Corrugated neck prevents turning.



RUNNING BOARD BOLTS
Large, round head gives firm grip, long life. Made with lugs or fin under head.



COLLAR RIVET BOLT
For fastening wood and steel together. Collar fits inside wood, with head riveted over the steel.

FLUSH HEAD FREIGHT CAR BOLT
Widely used for flooring, etc. in freight cars. Fits flush without counter-boring.



CARRIAGE BOLTS
Accurately made, rolled and cut threads, all lengths and diameters. Special styles available.



PLOW BOLTS
Flat top countersunk head, square neck. A very useful car-builders bolt. All sizes.



T-HEAD BOLTS
A machine bolt for use where head must be flush with surface of work.



COUNTERSUNK HEAD BOLTS
Another popular type for flush applications. Made in a complete range of sizes.



MACHINE BOLTS
All popular sizes and styles. Standard heads include: square, hexagon, button, etc.



RIVETS
All sizes, lengths and heads required for railroad use are included in the Oliver line.



OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH AND MURIEL STREETS · PITTSBURGH, PENNSYLVANIA

AFTER 5 YEARS

Improves with age



THIS STATEMENT IS CONFIRMED BY

A.A.R.

MECHANICAL DIVISION

CIRCULAR DV-1048

The following information is taken from pages 27 and 38 of the circular mentioned.

Miner Class A-22-XB, Cylinder D-7935...These were in good shape externally, with the appearance of practically no wear on the housing or shoes.

COMPARISON OF TEST RESULTS WITH TEST RESULTS FOR NEW GEARS

Average Capacity of New Gears	Average Capacity of Gears after 5 Years' Service	Increase in Capacity of Service Gears over New Gears
20,100 Ft. Lbs.	22,900 Ft. Lbs.	Plus 13.93%

W.H. MINER INC.
CHICAGO

Use our Unit Exchange Plan to

What the Plan is:

Our Unit Exchange plan for Alco-G.E. locomotives is a service which makes constantly available to you a pool of interchangeable equipment units, such as motors, generators, and superchargers. Rather than repair a worn unit, you can quickly exchange it for one from the pool, so that your locomotive can continue on its way while the worn unit is being repaired in the nearest Alco-G.E. service shop. Sixteen conveniently located warehouses stock these units and we can draw on any one or all for the parts you need in a hurry. The number and types of units stocked in each warehouse are determined by the number of locomotives operating in the adjacent area.



How the Plan Operates:





1. When you need a locomotive motor, for example, telephone our nearest service shop, warehouse, or office.

2. Prompt delivery will be made from the nearest warehouse to any designated point on your lines, so that . . .

3. . . . you can remove the worn motor install the new one at the same In this way . . .







4. . . . your locomotive goes back to work quickly, releasing shop space, man power, and equipment for other maintenance operations. And . . .

5. . . . in the meantime, the replaced motor is speeding back to the nearest Alco-G.E. factory or service shop . . .

6. . . . where we have complete facilitie do a thorough reconditioning job. W reconditioned, the motor is placed in the Exchange stock, ready for the next call.

Alco GE

The best investment in the world is in this country's future—BUY WAR BONDS



AMERICAN LOCOMOTIVE AND GENERAL ELECTRIC

speed maintenance, boost ton-mileage, and save time and materials

HERE'S HOW . . .

REDUCES OUT-OF-SERVICE TIME For periodic overhauls you can schedule an exchange unit to arrive when it's needed. Then remove the worn unit and install the new one in one operation and put the locomotive back into service.

RELEASES YOUR MAN POWER Your men can proceed with other jobs while our men do the repair work they are specially trained to do.

ELIMINATES WAITING There is no delay while worn parts are being shipped to and from remote repair points, or while lengthy repairs are being made.

CONSERVES VITAL MATERIALS You avoid duplication in your stock of items carried in our warehouses, making more material available for war.

MAKES UNITS IMMEDIATELY AVAILABLE No "red tape." Replacement units are in our warehouses—ready for immediate delivery and installation.

. . . and OTHER ADVANTAGES

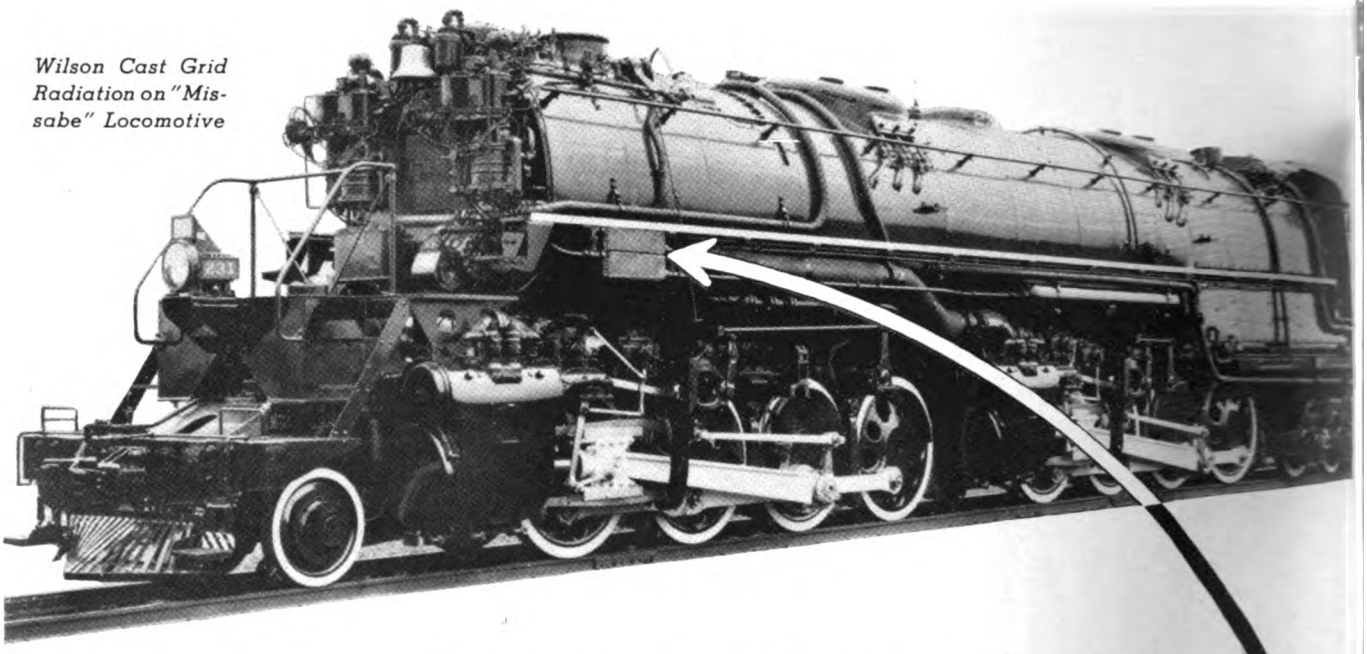
FREES SHOP SPACE Use your shops only for work which cannot readily be sent out.

RELEASES SHOP EQUIPMENT Ease the pressure on your equipment by using our facilities—they are specially designed to service Alco-G.E. units.

REDUCES PARTS INVENTORY We maintain a pooled stock of units in 16 warehouses and can assure you quick delivery.

INSURES BETTER REPAIRS Our men are specially trained to service diesel-electrics.

AVAILABLE SOON—a detailed description of the plan, with listings of the units available, the 24-hour service shops, and the warehouses where Unit Exchange items are stocked. Write now to General Electric Company, Sec. 113-54, Schenectady, N. Y. for GEA-4158. We'll send your copy as soon as it comes off the press.



Wilson Cast Grid Radiation on "Missabe" Locomotive

Wilson Variable Radiation effects complete primary cooling

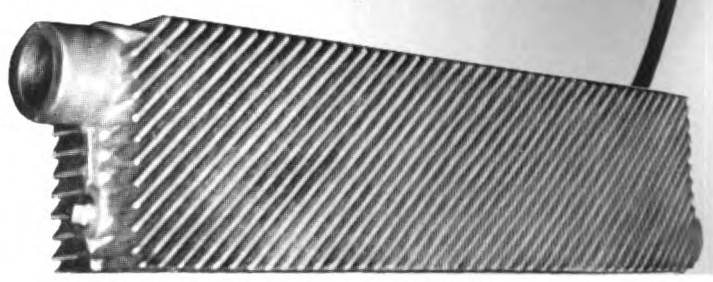
Trouble-producing moisture in locomotive compressed air must be precipitated . . . this is generally understood.

If *primary* cooling is complete and efficient *before* the air enters No. 1 main reservoir, all the moisture will be precipitated in the reservoir where it can be quickly removed.

And . . . the capacity of the reservoir is thus greatly increased. Due to the difference in density between hot and cold air, this increased reservoir capacity may be considerable.

Wilson Radiation presents an efficient and compact all-cast-iron grid element for either primary or after cooling. Its construction eliminates the use of such war-critical materials as steel or copper pipe.

And, Wilson Grid Radiation costs less . . . has the durability of cast iron . . . is tested to 500 pounds per square inch before shipment.



Wilson All-cast-iron Grid Elements

WILSON PRODUCTS

Unit Heaters · Blow-off Cocks
Mufflers or Separators
Feed Water Heaters

WILSON ENGINEERING CORP.

122 S. MICHIGAN AVENUE, CHICAGO, ILL.



Train after train goes thundering across the continent in the greatest "Track Race" of all time.

N • B • M

CAR JOURNAL BEARINGS AND ENGINE CASTINGS

will help you win with all odds in your favor.

NBM

NATIONAL BEARING METALS CORPORATION

ST. LOUIS • NEW YORK

AMERICAN Brake Shoe COMPANY

A Better Positioner for every welding job

No matter what type welding you do there's a C-F Positioner exactly suited to your requirements. Ranging from small hand operated models like the one above to the giant, push button controlled, monster shown below, C-F Positioners revolve weldments a full 360 degrees, tilt them to 135 degrees beyond horizontal — permit down-hand welding of all sides with a single set-up. All are universal tools; *are adjustable for height*, handle a wide range of work and are pedestal or boom mounted to give maximum floor and working clearance.

Write for Bulletin WP 22

CULLEN-FRIESTEDT COMPANY

1324 S. Kilbourn Ave.

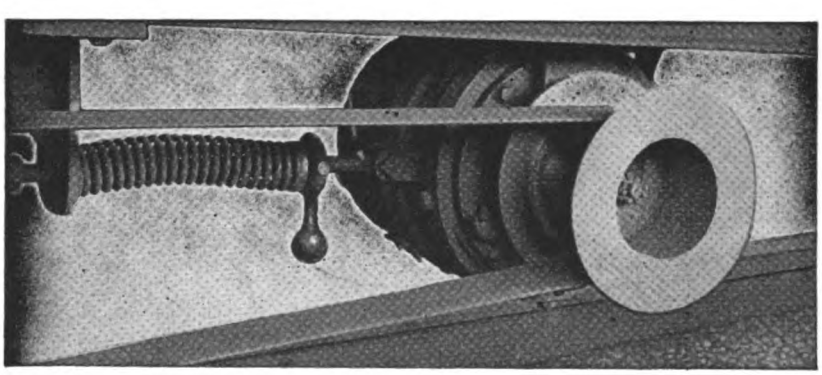
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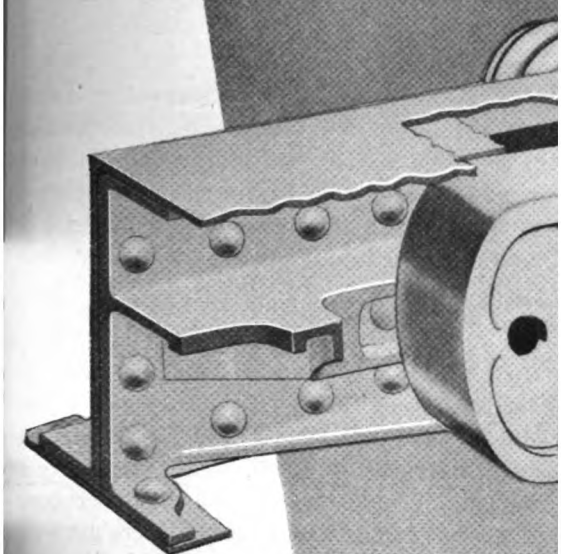
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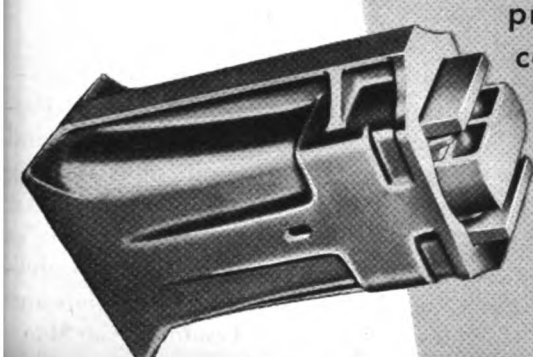
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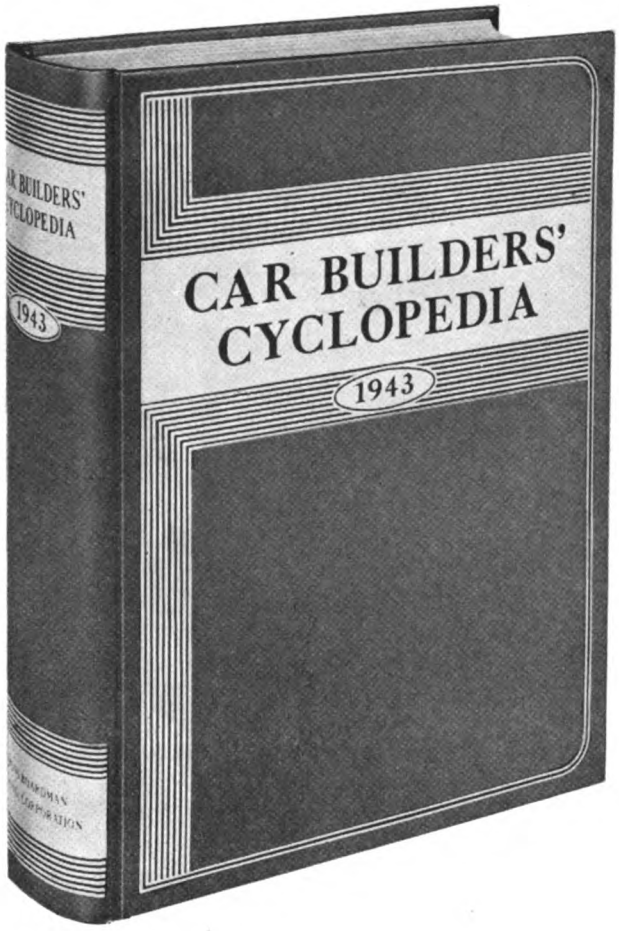
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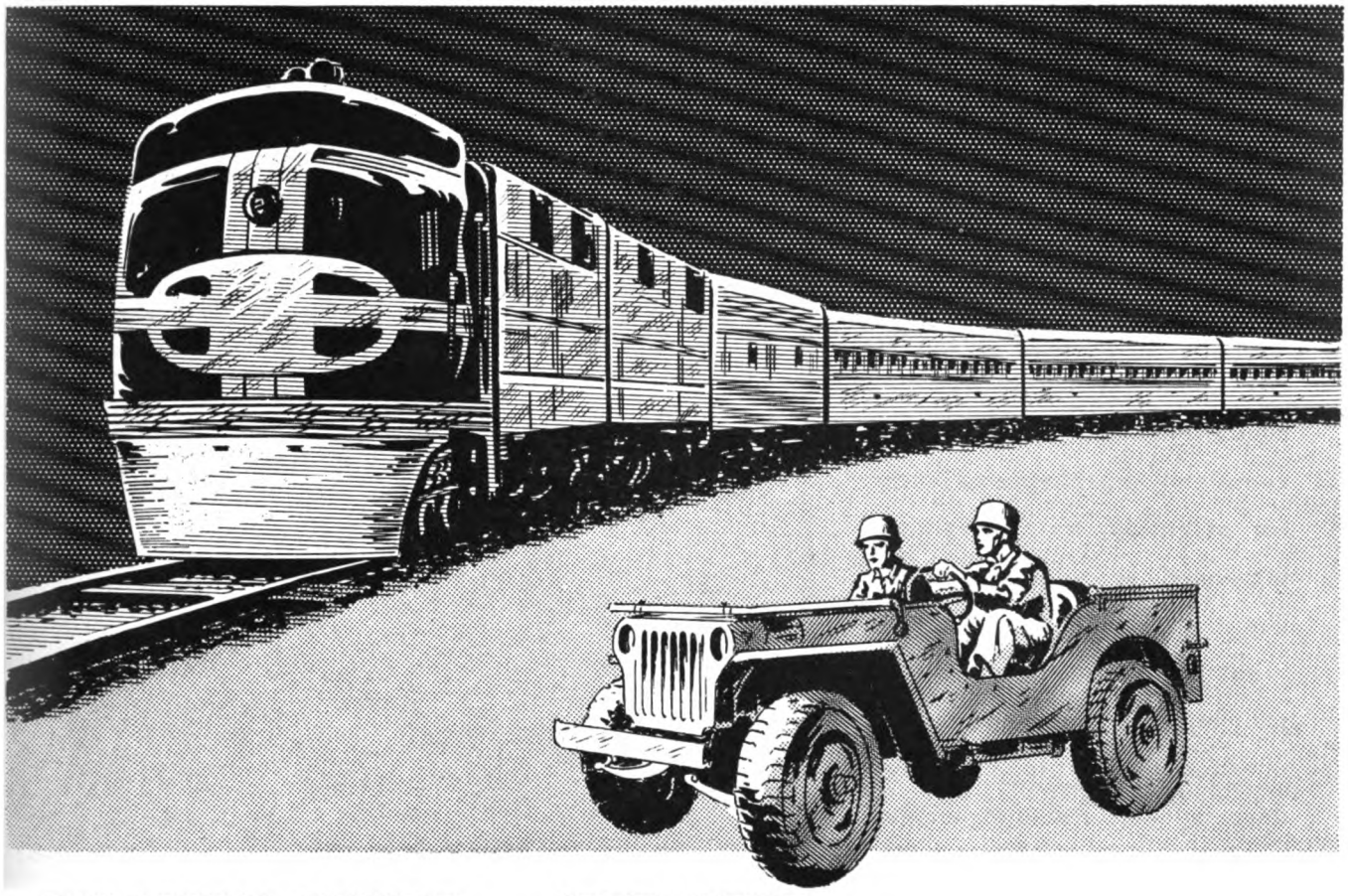
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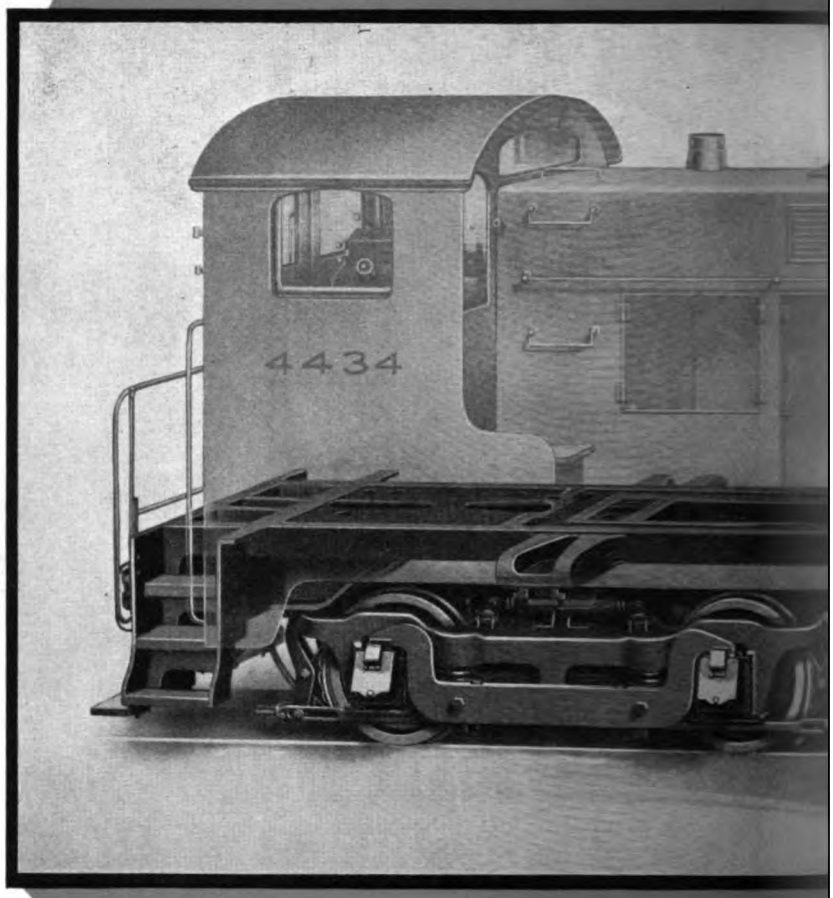
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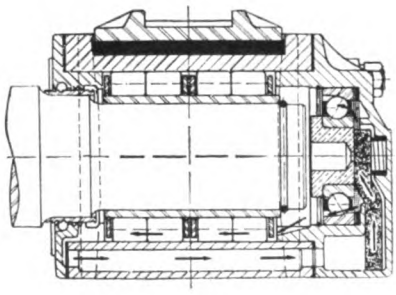
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State of New York } ss.
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Before me, a Notary Public in and for the State and county aforesaid, personally appeared Roy V. Wright, who, having been duly sworn according to law, deposes and says that he is the Editor of the *Railway Mechanical Engineer* and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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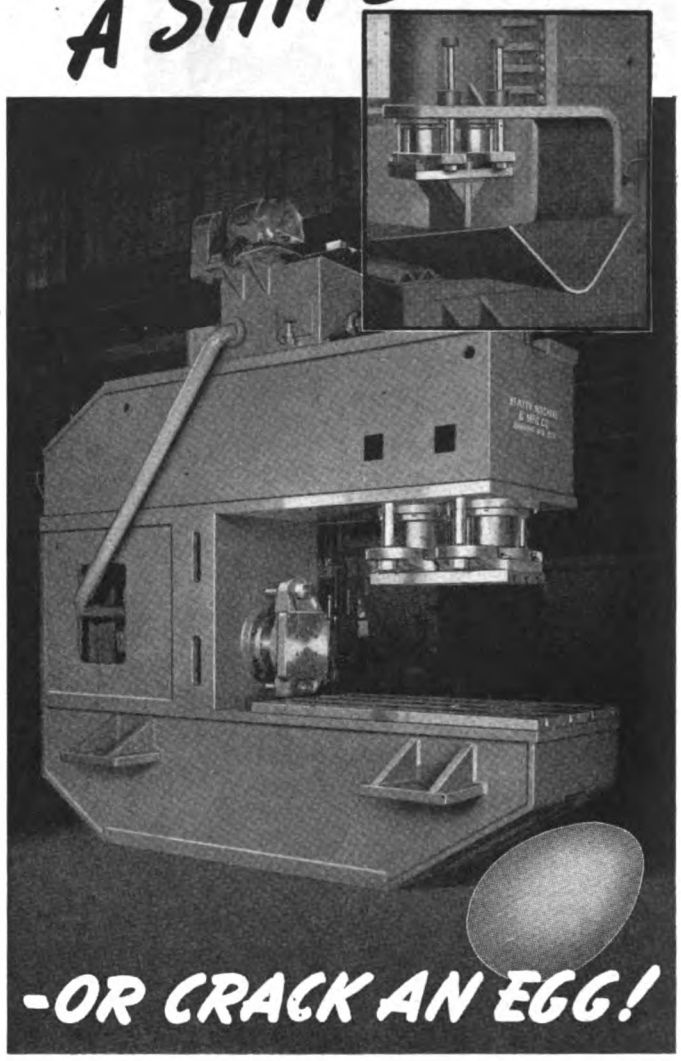
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Fig. 1.



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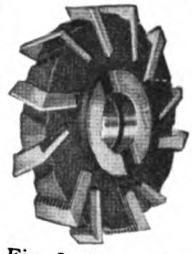


Fig. 2—No. 610

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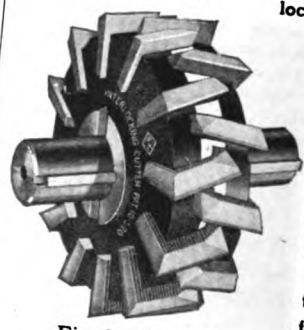


Fig. 3—No. 600

Fig. 2—O K Alternate-Angle Slotting Cutter for milling slots up to a limited width. Blades are adjustable for maintenance of width.

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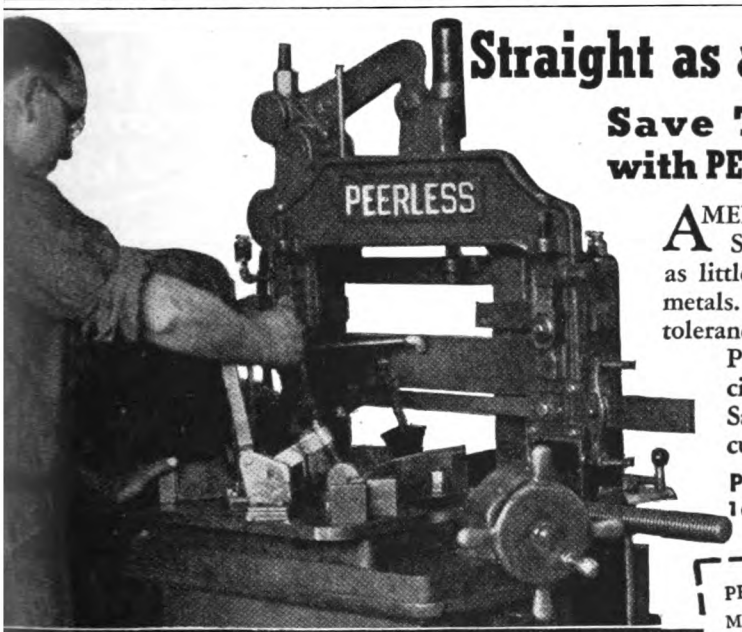
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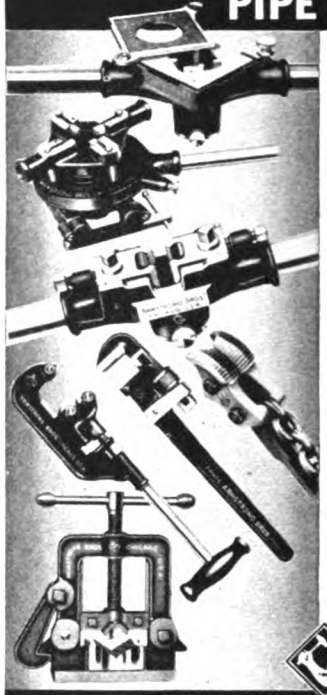


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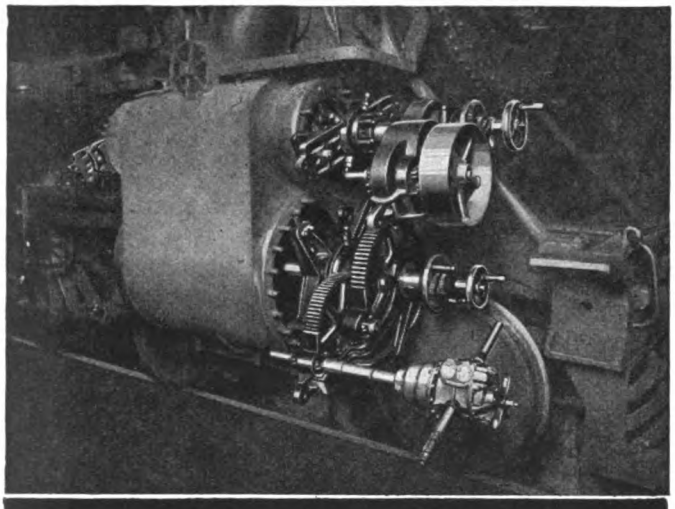
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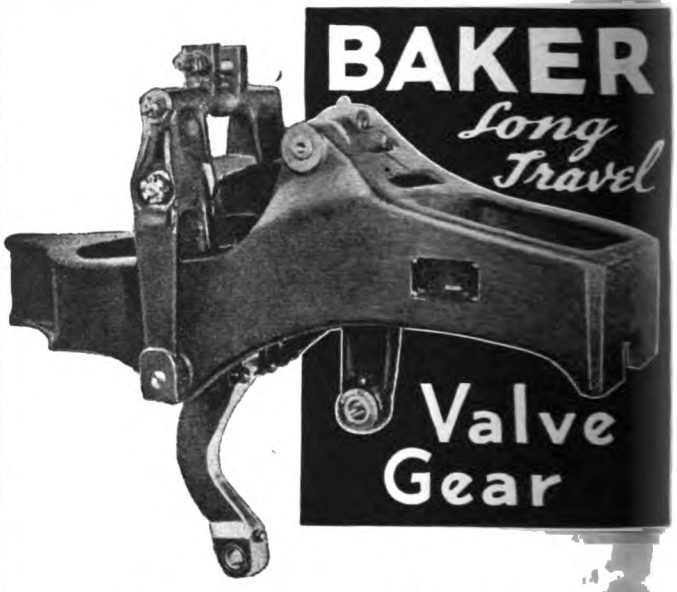
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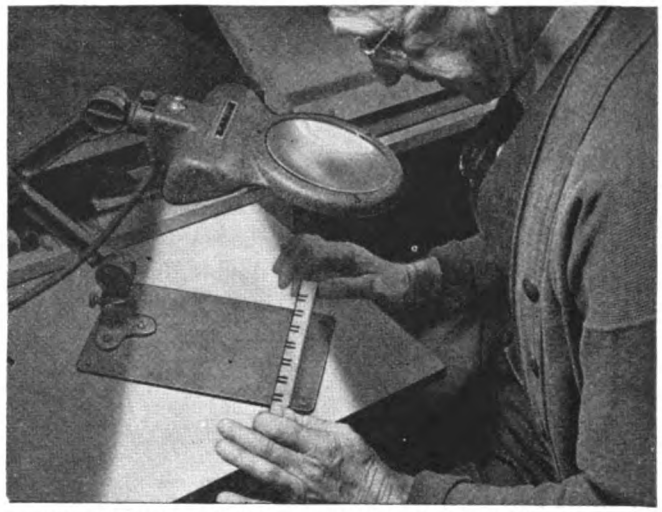
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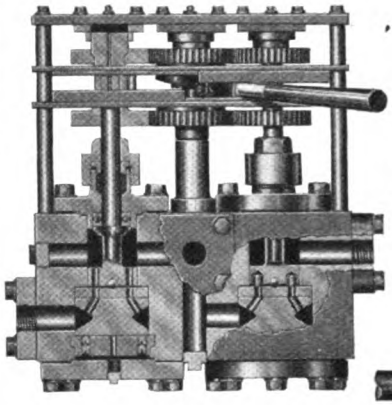
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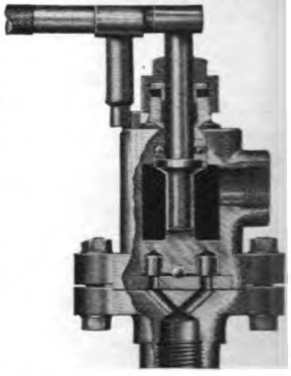
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A turn of the wrist operates the Hydra Venturi-Vacuum Valve and no matter how high the pressure there is no shock on the line when closing. Other important features,—no springs or cups to bother with, reduced maintenance cost, long life. Many installations in the Steel, Rubber, Packing, Car Building, and Foundry Industries support these claims.

Write for descriptive folder.

ALBRIGHT EQUIPMENT CO.
FERNDALE, JOHNSTOWN, PA.

SAFETY = MORE EFFICIENCY MORE PRODUCTION

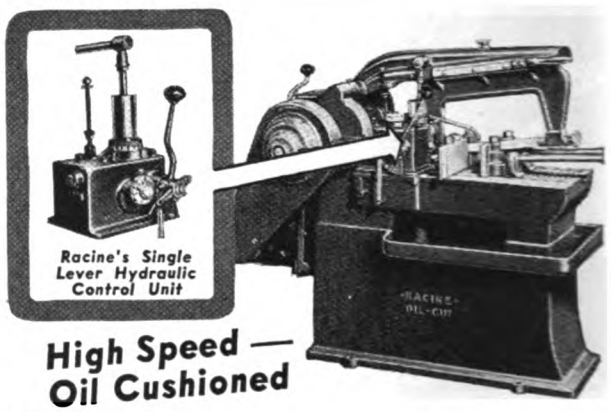


Ease of handling; unobstructed vision; self-stabilizing feature for handling loads at sides; always-in-gear design; and automatic braking in all crane operations . . . these and other advanced engineering features provide the SAFETY required to meet the exacting demands of the War effort. 2½, 5, and 10 ton capacities. Agents in all of the principal cities.

USERS: Union Pacific; Missouri Pacific; B & O; Chesapeake & Ohio; Pennsylvania; Canadian Pacific; Illinois Central; Southern Pacific; etc.

Krane kar
FOR RAILROADS

SILENT HOIST WINCH & CRANE CO., 845 63RD ST., BROOKLYN, N.Y.



High Speed — Oil Cushioned

RACINE metal cutting saws

PRECISION CONTROL OF FEED AND PRESSURE

The Production Saws of Modern Industry

Efficient, accurate control is essential in War Production today. Racine provides this precision with the above compact control unit. A flexible feeding action that automatically regulates itself to the kind, size and shape of work, speeds production and saves blades. Capacity 6"x6".

Other Features of Racine "Oil-Cut" Saws

Three-speed transmission for high speed production — Adjustable Saw Guide — Saw frame eliminates blade distortion. Other model Racine Saws in capacities ranging from 6"x6" to 20"x20".

Complete information and prices furnished on request. Address Dept. RE-S.

Investigate Racine's Oil Hydraulic Pumps & Valves

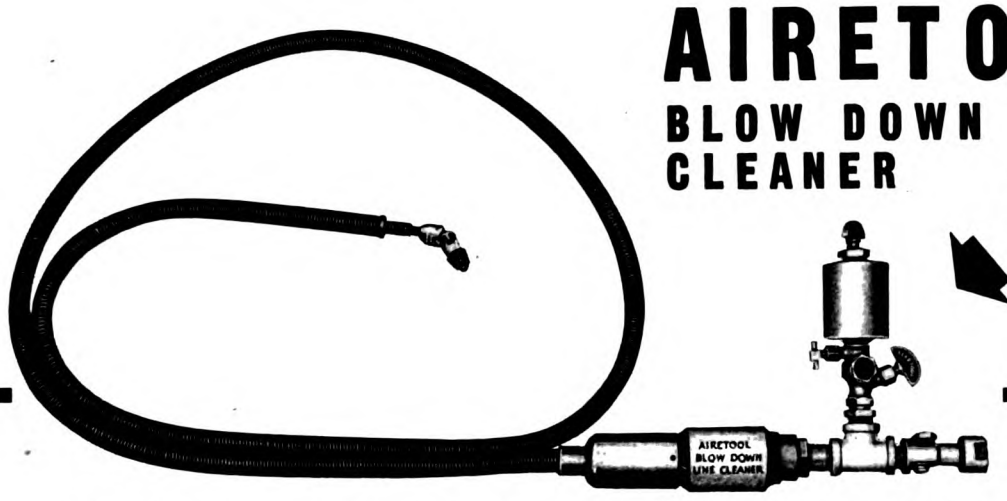


Pumps—Cap. 0 to 30 G. P. M. Pressures up to 1000 lbs. Four-Way and other Oil Hydraulic Valves—⅛" to 1½" pipe sizes.



RACINE TOOL and MACHINE COMPANY
Standard for Quality and Precision
RACINE, WISCONSIN • U. S. A.

AIRETOOL
BLOW DOWN LINE CLEANER



CLEANS F-A-S-T-E-R • MORE ECONOMICALLY

Airetool's Blow Down Line Cleaner will remove scale and foreign deposits in tubes faster because of Airetool's unique power seal motor that gives extra power and because of Airetool's accurately heat treated alloy steel non-tracking cutters. And, it does the job more economically. The savings in time—as much as one-half—and the fact that Airetool cutter replacements are needed less often is the reason. In an actual test Airetool Cleaners need cutter replacements *only 24% as often* as a competitive cleaner.

In addition Airetool manufactures an equally efficient cleaner for every type of locomotive pipe cleaning job—for Arch Tubes, Branch Lines, Nicholson Syphons, and the new type Circulating Tubes. Learn all about these labor, time and money saving Airetool Cleaners and how they can help you.

Write For BULLETIN R-17 Today.

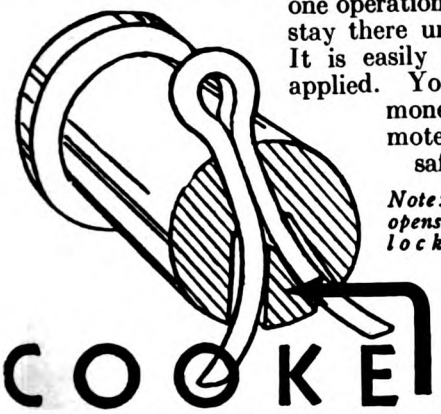
AIRETOOL MANUFACTURING COMPANY

Greater SAFETY For a Lower Cost

WHY take chances with ordinary cotters—especially since the speeds of all trains have been increased?

Every application on a car, locomotive or any other moving vehicle can be made in absolute safety with the COOKE Pin and Cotter.

A couple of taps with a hammer drives the COOKE Cotter into place. It is securely locked in one operation—and it will stay there until removed. It is easily and quickly applied. You save time, money and promote maximum safety.



Note: This wedge opens, spreads and locks the cotter, thereby eliminating vibration and wear.

COOKE PIN and COTTER

"SELF OPENING—SELF LOCKING"

American Railway Products Co.

162 Post Road, Darien, Conn.

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A USEFUL **PROTRACTOR** AND A **REPAIR HAND BOOK**



The 40-page Smooth-On Handbook contains 170 diagrams and easy-to-follow instructions for making economical and lasting repairs to railroad equipment, pipe lines, machinery and fixtures of all kinds.

USE SMOOTH-ON . . . a dependable iron cement that, since 1895, has been used by engineers and mechanics for making lasting repairs. Buy from your supply house or if necessary, direct from us, in 7-oz., 1-lb. and larger containers.



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Please send the FREE protractor and Smooth-On Handbook.

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***Do it with* SMOOTH-ON**

THE EDITOR'S DESK

THE PEAK PASSED, BUT NO LET-DOWN IN SIGHT

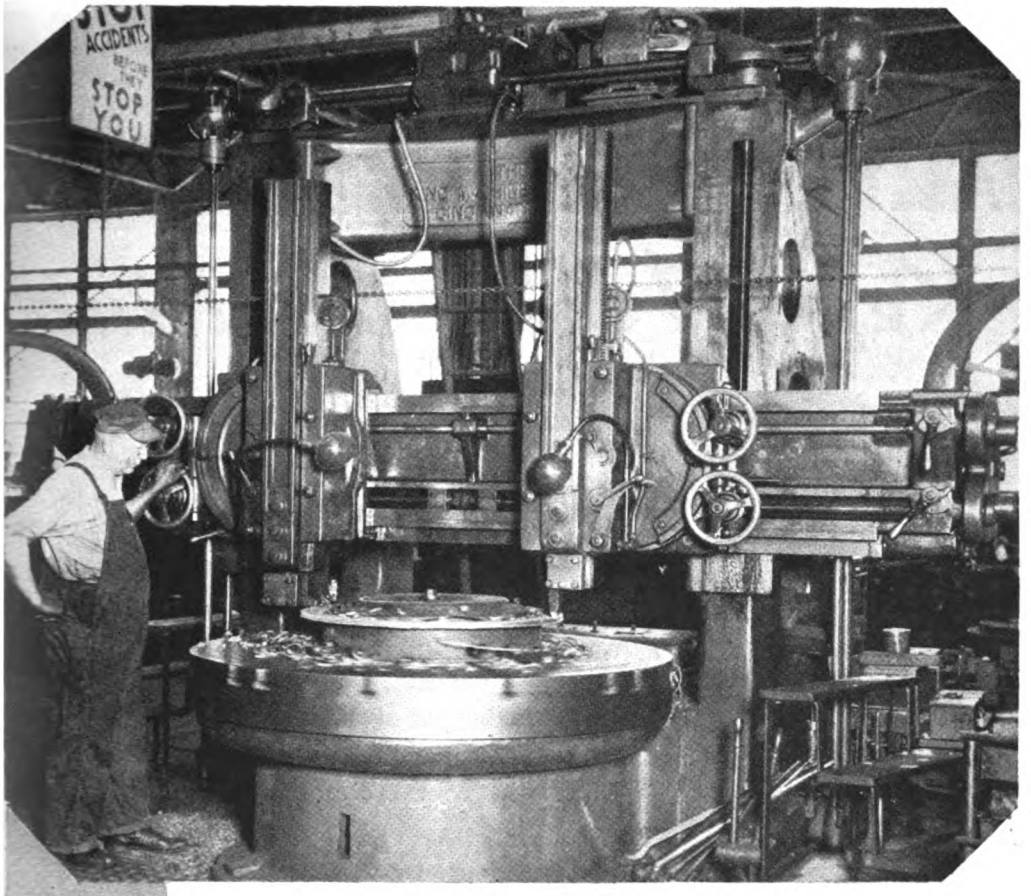
The railroads are to be congratulated upon the remarkable record they have made in 1943. The October peak has been passed safely, but they will be faced with heavy traffic during severe winter weather, with no possibility of a let-up after it is over, unless, perchance, the Nazis should crack and one phase of the World War should come to an end.

The railroads have certainly had no break as to priority of equipment or manpower and it has been a difficult fight to secure enough material to maintain the cars and locomotives. Mechanical department officers have been at their wits end to keep the equipment in such shape that it could continue to function under heavy duty. It is to be hoped that the War Production Board will find it possible to loosen up and permit the railroads to add to their cars and locomotives. The railroads mean so much to the successful carrying on of the war that they must not be permitted to deteriorate to a point where they cannot meet the demands that will be made upon them. In other words, it is just as essential that they be furnished with the necessary supplies and equipment as it is to protect the branches of the armed services.

Readers of the *Railway Mechanical Engineer* and those who review the reports of the mechanical associations in this number, must have a keen realization of the extent to which the mechanical department forces have used their wits and energies and have made the best possible use of those materials and such manpower as was available.

Fortunately the splendid showing that the railroads have made under severe handicaps is being appreciated by the public in general, and the Army and Navy officers in particular. This encouragement is heartening and is an inspiration to keep up the fight and put forth even greater efforts.

Roy V. Wright



King 72"

BORING MILL

WORKS FOR THE RAILROADS AND THE GOVERNMENT

KING BORING MILLS are doing their bit on every industrial front—and a good percentage of the installations are working 24 hours a day.

The demand upon the versatility of King Boring Mills is exemplified by the above 72" unit installed in a large western locomotive repair shop.

The job on the machine is a 39" dia. smoke box door — simple — nothing to it but, the job which preceded it, was a large cylinder liner for a vessel on the Pacific Coast.

The regular railroad jobs handled on this King Mill include cylinder bushings, wheel centers, tires and all sorts of heavy boring and turning jobs — handles all of them and works overtime for the government.

The KING MACHINE TOOL Company

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO

"Four Way"

BRAKE MAINTENANCE

Helps Keep Trains Rolling

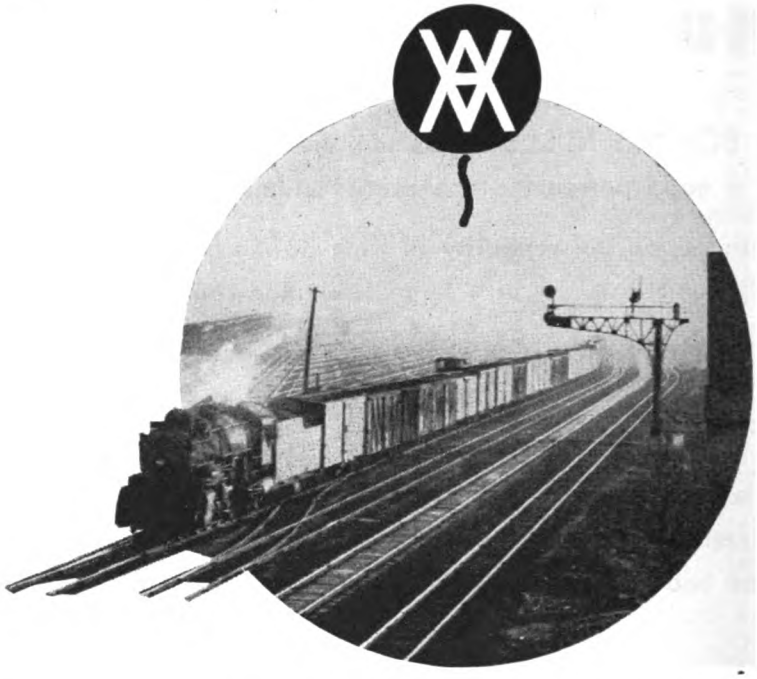
Since the function of Air Brakes in safeguarding and expediting vital freight is even more important today than ever before, we offer the following suggestions as effective means to keep them in good condition.

1 An out-of-order valve should not be taken apart while it is on a locomotive or car. Remove the complete device, or portion, and replace with one known to be in good condition, keeping exposed internal surfaces protected from dirt and injury. All inspection, cleaning and oiling should be done at a shop bench.

2 If minor replacements are necessary, it is sound practice to use "genuine" parts, to insure a good maintenance job without extra machining or fitting. Time and labor are minimized, reliable service prolonged.

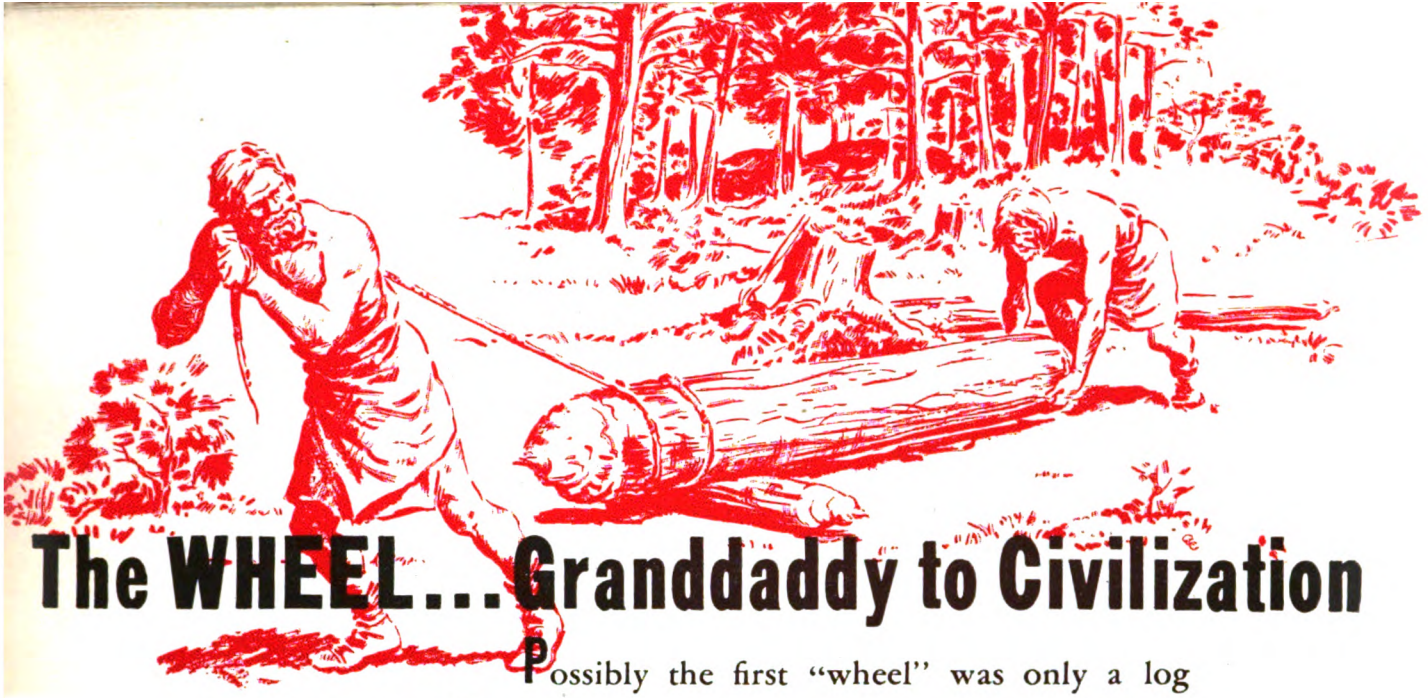
3 When a valve needs major repairs, let us do this work for you. We have adequate and proper facilities—skilled mechanics, improved methods, accurate machines and tools. Exacting standards in materials and workmanship are thus maintained, correct performance of reconditioned apparatus is guaranteed.

4 Consult our field men freely concerning your problems of air brake operation and maintenance. They are eager to help you get the best service from your existing equipment on hard-working cars and locomotives.



WESTINGHOUSE AIR BRA[illegible].

WILMERDING, PENNSYLVANIA



The WHEEL... Granddaddy to Civilization

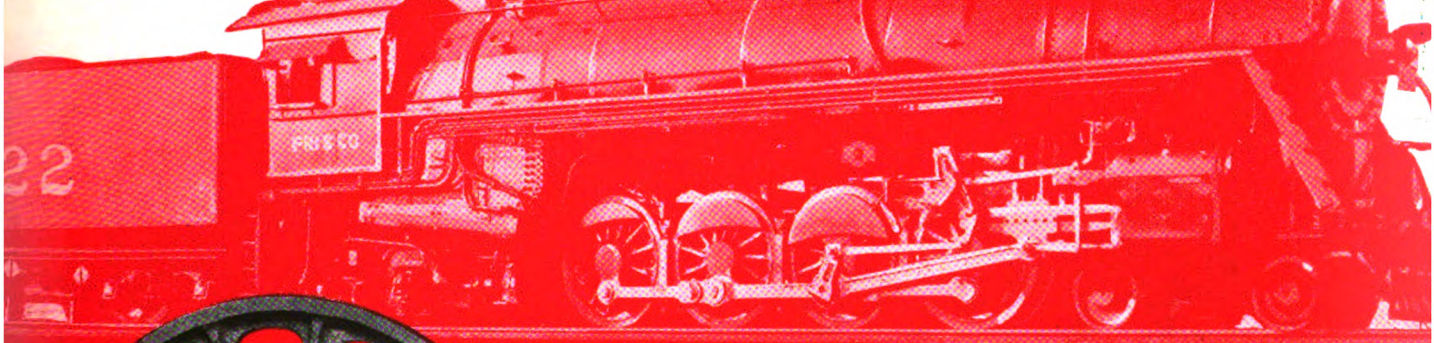
Possibly the first "wheel" was only a log which some pre-historic man accidently set to rolling, which in turn set the man to thinking. But, whatever its origin, it surely started man on his way, made possible much of the progress he has since enjoyed.

Here at Union Steel our preoccupation with the wheel has produced the unique Web-Spoke Driving Wheel Center. With it the modern locomotive is better able to meet today's demand for faster, heavier railroad traffic.



UNION STEEL CASTINGS

DIVISION OF
BLAW-KNOX CO.
PITTSBURGH, PA.



The Frisco engine above is equipped with Union's Web-Spoke Driving Center, as are many other famous locomotives.



UNION WEB-SPOKE DRIVING WHEEL CENTER

Insert illustrates adaptation of one wheel for front, back and intermediate positions, with auxiliary pockets for precision balance. Note these important features:

1 Cruciform section spokes for great additional strength.

2 Reinforced rim support to eliminate flat spots, out-of-roundness, etc.

3 Correct distribution of metal for better balancing of small-diameter wheels.

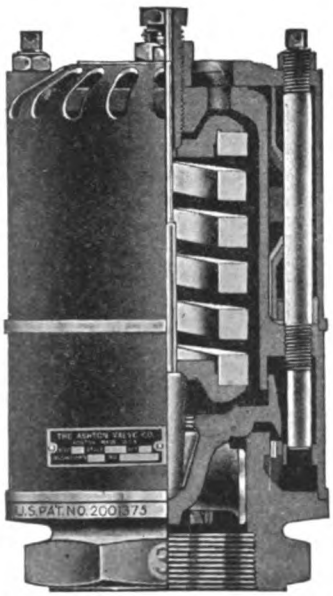
4 Wheels easily inspected before and after installation.

5 Troubles due to shrinkage eliminated by simplicity in design.

6 Can be made to any material specification.

We will be pleased to show you the specific application of this wheel design to any of your power If you will drop us a line — you incur no obligation by so doing.

BACK THE ATTACK — BUY U. S. WAR BONDS



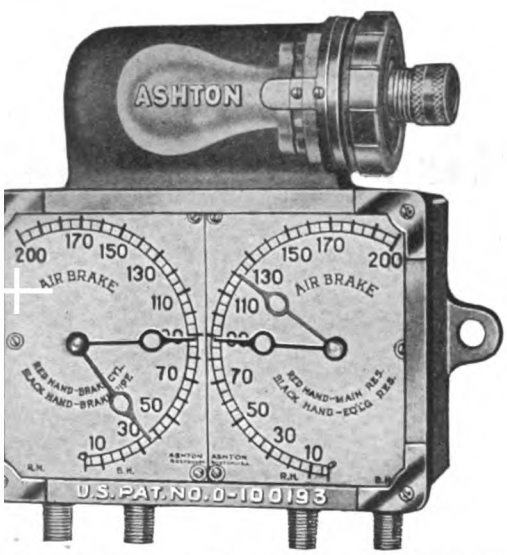
ASHTON FC-10 MUFFLED SAFETY VALVE

0 Muffled Locomotive Safety Valve was developed the condition of increased evaporating efficiency on sure locomotive boilers. It has operated successfully iod of over ten years in road tests and regular service iotives carrying pressures up to 300 pounds per square oughout this period it has operated without the necessity noval of any parts.



ASHTON NO. 52 DI-3 6¾" DOUBLE DIAL LOCOMOTIVE STEAM GAGE, LAMP HOUSING CAST INTEGRAL WITH CASE

The New Style No. 52 DI-3 Locomotive Steam Gage eliminates the need of separate boiler pressure gages for engineer and fireman. Each face of the Gage has a dial and hand illuminated by a standard electric lamp bulb and can be seen from either right or left side of the locomotive. Dial has a permanent white porcelain surface which is positively non-glare and can readily be cleaned.



NO. 62 QI-7 QUADRUPLEX ILLUMINATED LOCO- AIR BRAKE GAGE. LAMP HOUSING CAST INTEGRAL WITH FACE RING.

:ipal object of this new design is to place in a central- ition the two air gages and the indicating hands of ıear together as possible, so that the engineer by con- ; his vision particularly on the brake pipe and equalizing hands may regulate more uniformly and accurately his ıplications and secure smooth handling of the train.

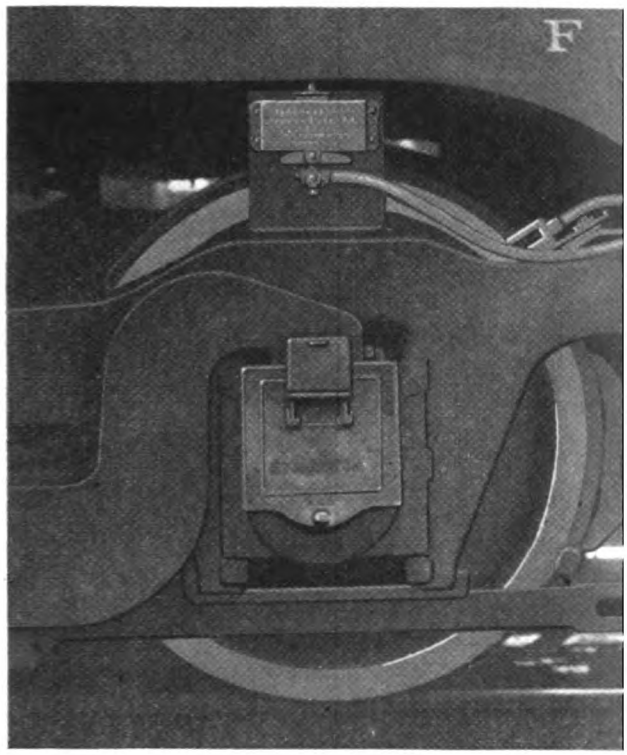


ASHTON NO. QI-9 QUADRUPLEX ILLUMINATED LOCOMOTIVE STOKER GAGE

The Ashton Locomotive Stoker Gage is a combination of two duplex gages, ordinarily used in stoker service, mounted in heavy rectangular dust-proof case.

Combining the two gages in one case reduces the space required for this equipment in locomotive cabs. Especially adapted to service on the HT and HT-I stokers or other types where three or four pressure indications are required.

THE ASHTON VALVE COMPANY
161-179 FIRST STREET, CAMBRIDGE, MASS.
O, ILL. NEW YORK, N. Y. SAN FRANCISCO, CAL



Swanson Fla

SWANSON
FLANGE OILER

NEW IMPROVED DESIGN

WILL SAVE TONS (

RAILS—REDUCE THE I

The Valve opens when the en
when the engine is at rest. The
spreading on tread of wheel.

Thousands of Swanson C

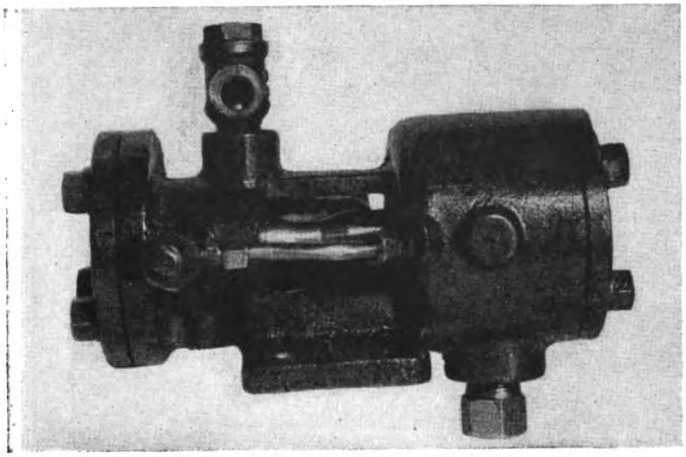
We manufacture Flange Oilers
Locomotives.

Write Tod

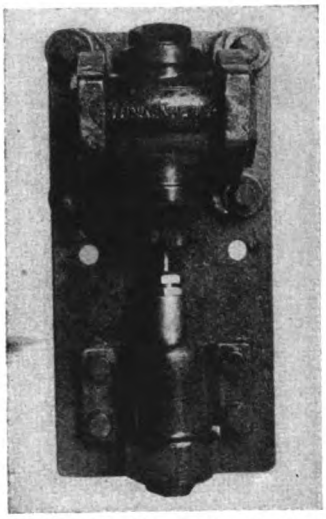
The SWANSO

1644 Farragut Ave.

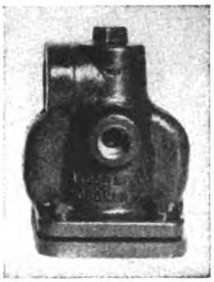
Maximum Protection for Locomotive Cylinders



Control Valve located on bracket near balancing valve.



Balancing By-Pass Valve, located on steam chest.



Auxiliary Throttle located at the dome.



Ardco Automatic Air-Operated Cylinder Cock.

THE modern locomotive with its one-piece bed represents a huge investment which must be protected against failures and long, expensive tie-ups for repairs.

No components are more vital than the cylinders. Application of ARDCO Automatic Drifting Equipment will play a big part in the prevention of failures and those maintenance items which greatly affect availability. By the automatic admission of a limited amount of steam during periods when the locomotive is drifting, normal lubrication is maintained and all wearing parts in the valves and cylinders are protected against the destructive results of hot corrosive gases and abrasive cinders which are drawn in from the smoke-box under ordinary conditions.

Performance reports of locomotives equipped with ARDCO Drifting Equipment show a big savings in valve and cylinder maintenance. Application is simple and does not require any change in the design.

ARDCO AUTOMATIC CYLINDER COCKS—will protect against damaged cylinders, bent piston rods, breakage of cylinder packing and other expensive repair items caused by trapped water or steam in the clearance spaces. They open automatically when the pressure in the cylinders exceeds boiler pressure. They operate by air pressure and will remain open automatically when the engine is in the enginehouse or on storage tracks.

We at ARDCO are proud to be doing our utmost for our armed forces. Recognition of this responsibility and the excellence of ARDCO production is evidenced by the triple "E" flag which proudly flies over our plant.



Ardco Manufacturing Co.

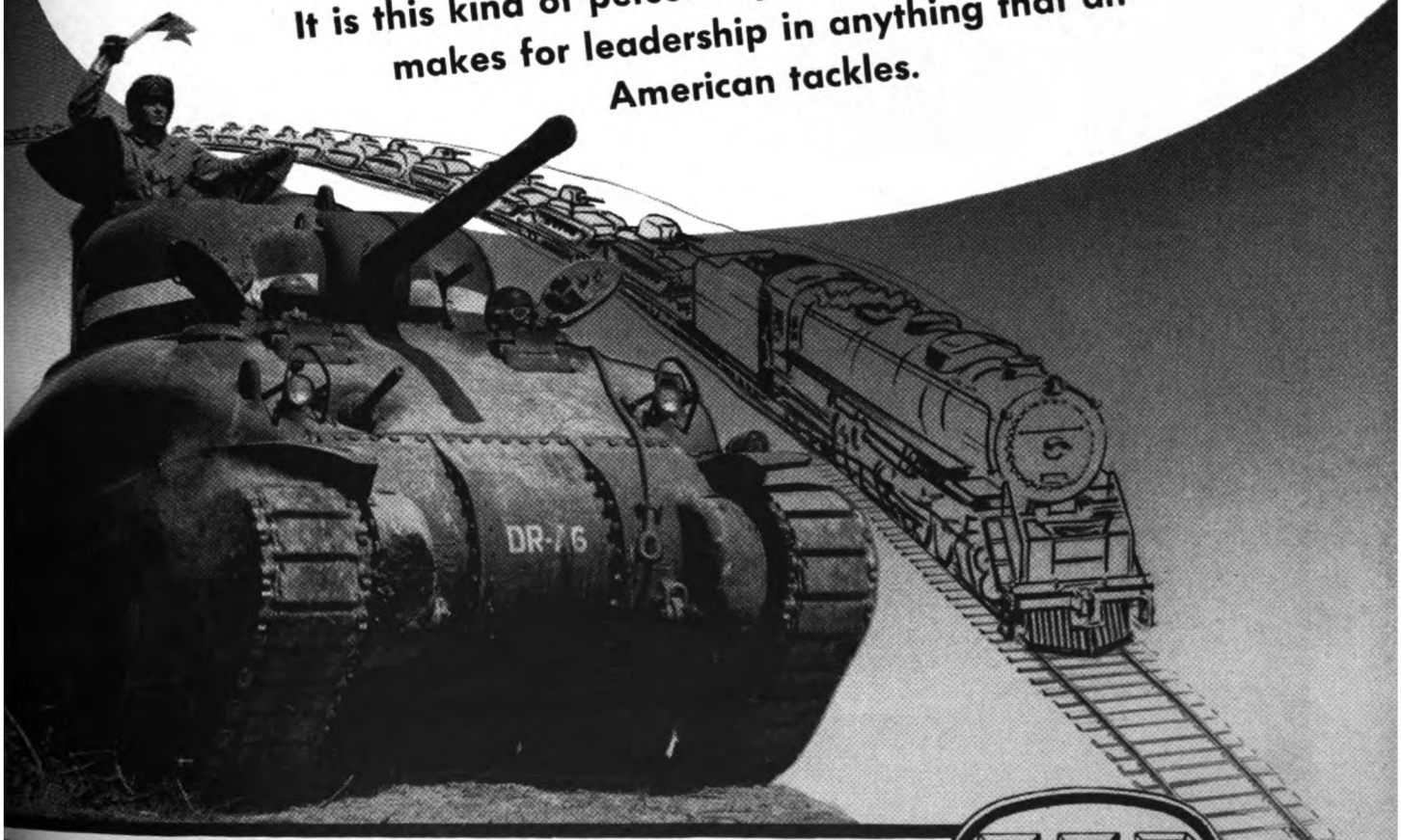
North Bergen, New Jersey

Ardco Automatic Drifting Equipment Automatic Cylinder Cocks

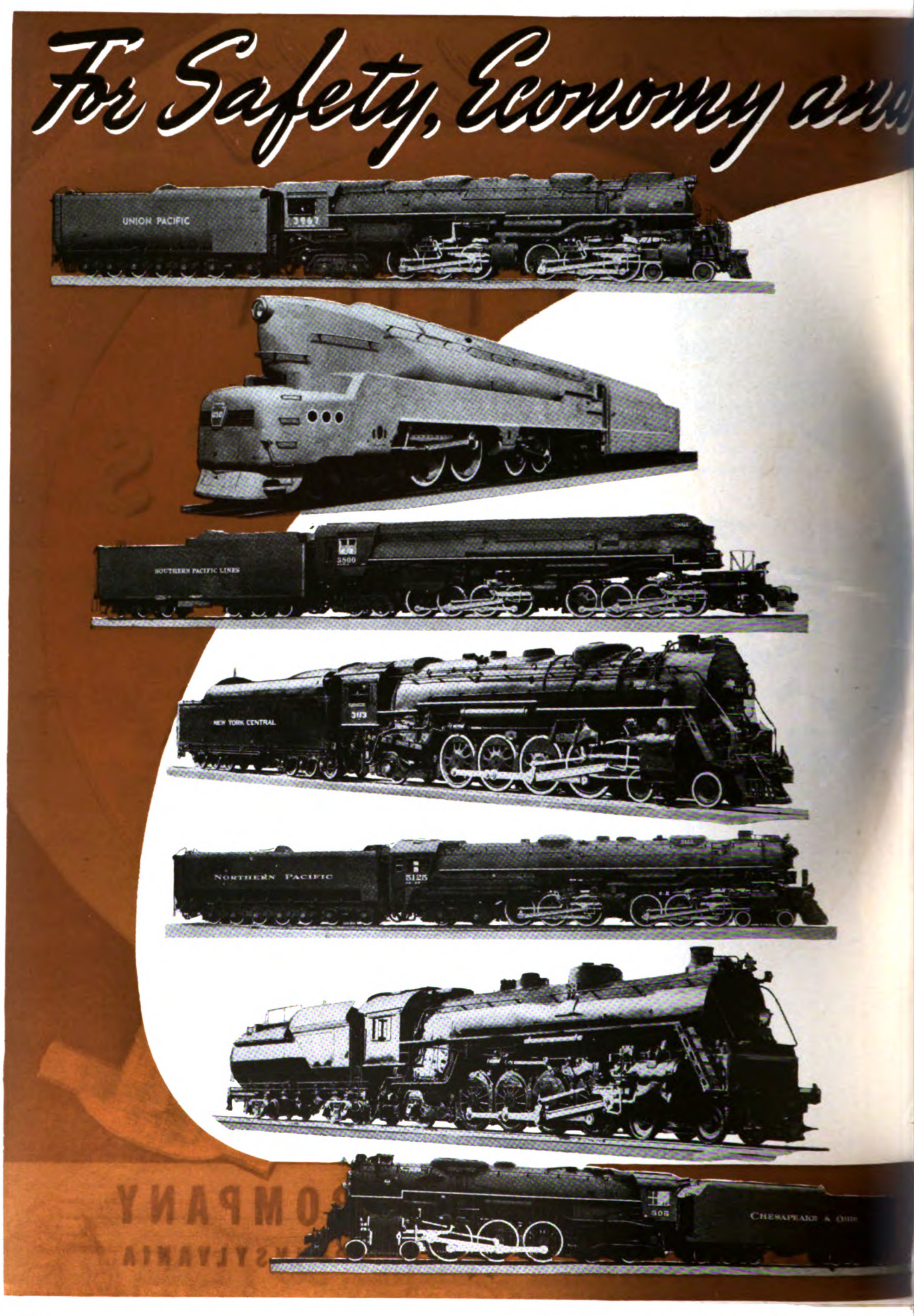
"STANDARD STOKERS"

The tank crew sees in its tank the best tank in the outfit.
The engine crew sees in its locomotive the best locomotive on the road.
We of Standard Stoker, who have built more than 16,500 Standard Stokers, see in our stokers the best locomotive stokers in the world.

It is this kind of personal pride in achievement that makes for leadership in anything that an American tackles.



THE STANDARD STOKER COMPANY, INC


For Safety, Economy and
UNION PACIFIC
3967
SOUTHERN PACIFIC LINES
5500
NEW YORK CENTRAL
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NORTHERN PACIFIC
5125
605
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High Availability . . .

HOLLOW *Flexible* STAYBOLTS



FLANNERY BOLT COMPANY

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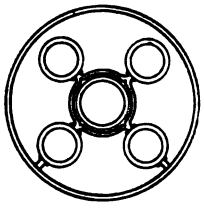
It's Not What You Make—



But What You Receive.

THE C-S SUPERHEATER

Deducts The Minimum



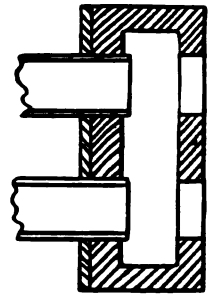
Section through flue

PRESSURE DROP through superheater equipment is a deduction made against effective boiler pressure at the cylinders.

Like payroll deductions, pressure drop is necessary—but should be no more than is required for adequate protection of the units.

The C-S Superheater is designed for a maximum deduction of only ten pounds—from dry pipe to cylinders.

Over a third of a million miles of service has proved this to be both safe and economical. Why deduct more?

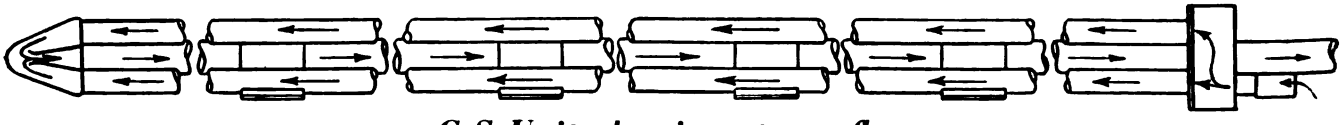


Section through front manifold

For details send for a copy of Bulletin C-SI

THE J. S. COFFIN, JR., COMPANY

ENGLEWOOD, NEW JERSEY

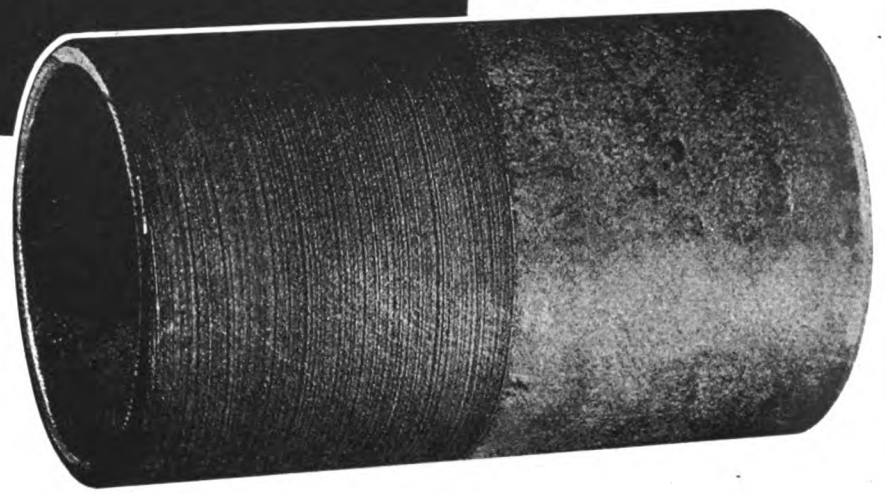


C-S Unit showing steam flow

APEXIOR SURFACING MATERIALS FOR INTERIORS OF LOCOMOTIVE BOILERS AND TENDER TANKS...

REG.U.S.PAT.OFF.

Fig. 1 — One half of this piece of standard locomotive flue has been surfaced with APEXIOR NUMBER 1.



APEXIOR NUMBER 1 is a brush-applied surfacing material for the water side of locomotive boiler flues, shells, firebox sheets and staybolts. The coating of APEXIOR protects against corrosion by filling and covering the surface of the metal to an average thickness of 0.0025 inch. Water contact with the metal and penetration of the metal structure is prevented. The character of the APEXIORIZED surface is such that dirt and scale do not bond as tightly as to bare steel. Boiler washing is more effective. Long operation of APEXIOR on heating surfaces at all pressures and ratings and in all types of boiler equipment has indicated no effect to retard heat transmission.

APEXIOR NUMBER 1 is not a substitute for feed-water preparation or chemical treatment. It supplies protection for metal in service under boiler water and steam temperatures and pressures, supplementing the work of the chemist and water service engineer by increasing the durability and raising the service quality of the boiler metal. It is the simplest and most effective kind of Mechanical cooperation with the Water Service Department.

It has been demonstrated on a number of railroads that APEXIOR surfaced metal means longer life of flue and sheet steel under boiler water, lower average maintenance costs and easier and more effective boiler washing.

Fig. 1 shows a piece of standard flue partially surfaced with APEXIOR or APEXIORIZED. The entire tube was passed through a sandblasting machine before the application. Sand-blast cleaning is not essential. It is, however, considered to be the most satisfactory cleaning method. Any steel surface that is dry and free from loose rust, scale, dirt or oil will bond properly with APEXIOR for longer and better service.

Badly pitted flues which were on the road to the scrap pile have been reclaimed, surfaced with APEXIOR and placed in active equipment.

Fig. 2 shows an area of APEXIOR surfaced boiler plate and rivet heads after two years' service at 215 pounds operating pressure. Observe that no metal is exposed. The protective surfacing has remained intact.

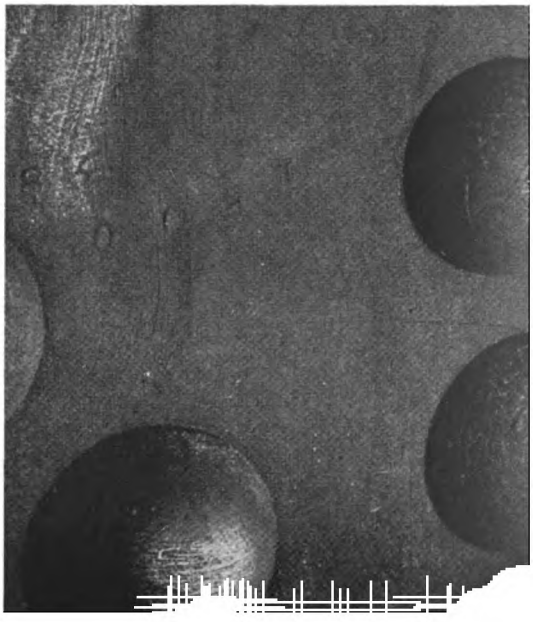
Service experience of five years on locomotive shells is now available. It has been fully demonstrated on several important Systems that APEXIOR is effective in railroad locomotive boilers to retard or check corrosion and pitting, and that any subsequent use of chipping hammers, air scaling tools or sandblast cleaning of shells after flues are removed, may be dispensed with. APEXIOR surfacing of staybolts and of other water contact areas subjected to the hazard of embrittlement or accelerated stress corrosion, may have interesting possibilities. It is the kind of modernization that assists any steam power unit to maintain its position against competitive types of power equipment.

APEXIOR NUMBER 3 is a protective surfacing material for the interior of general tank and tender equipment. It is brush-applied cold and dries a smooth, shiny jet black.

APEXIOR surfacing materials are well-known and have a wide distribution in stationary utility, railroad and general industrial power plants throughout the country, and in the marine field. Shipped ready to apply after mixing in the container.

APEXIOR REG.U.S.PAT.OFF.

Fig. 2 — APEXIOR surfaced boiler plate and rivet heads after two years service under 215 pounds boiler operating pressure. Note brush marks and thickness of film over plate markings.

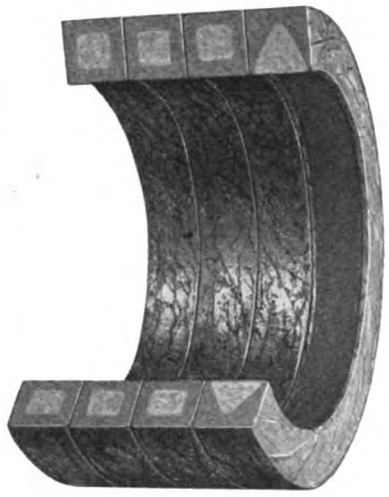


THE DAMPNEY COMPANY OF AMERICA

HYDE PARK · BOSTON · MASSACHUSETTS

ATLANTA NEW YORK PHILADELPHIA CHICAGO DETROIT

DURAMETALLIC Expansion Joint Packing

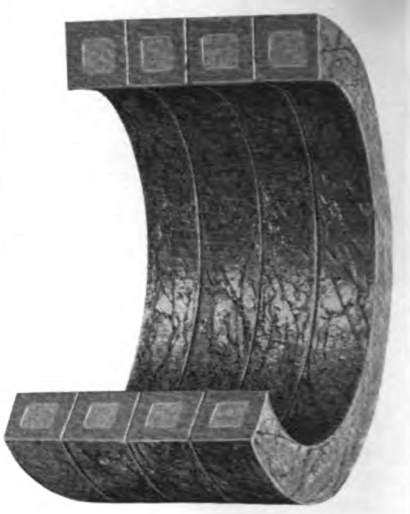


CROSS SECTION OF
DURAMETALLIC STLYE D-114

Shopping to Shopping Service on Saturated and Superheated Steam

FOR LONG UNINTERRUPTED SERVICE on locomotive expansion joints — specify Durametallic . . . an anti-frictional, flexible metallic packing with resilient core that insures a free working joint.

WRITE FOR ILLUSTRATED BULLETIN AND PRICES



DURAMETALLIC EXPANSION
JOINT PACKING — STYLE D-110

The PERFECT SEAL

DURAMETALLIC CORPORATION

KALAMAZOO MICHIGAN

Manufacturers of PACKINGS for — AIR PUMPS • STOKERS • EXPANSION JOINTS • CAB COCKS
WATER GAGE GLASS • FEED WATER PUMPS • VALVE STEMS • REVERSE GEARS AND DURA HOOK PACKING PULLERS



Many railway executives have found that workers themselves prefer Willson safety devices . . . wear them willingly . . . report them unusually comfortable.

This is due to the fact that Willson goggles and respirators are not made to fit any ONE face, but are so designed that, with slight adjustment, they will comfortably fit ANY of the facial types in the vast "melting pot" of American industry.

Because ALL Willson protection is scientifically engineered to yield the utmost in safety and comfort, it is given the "green light" by many railroad operating and safety officials.

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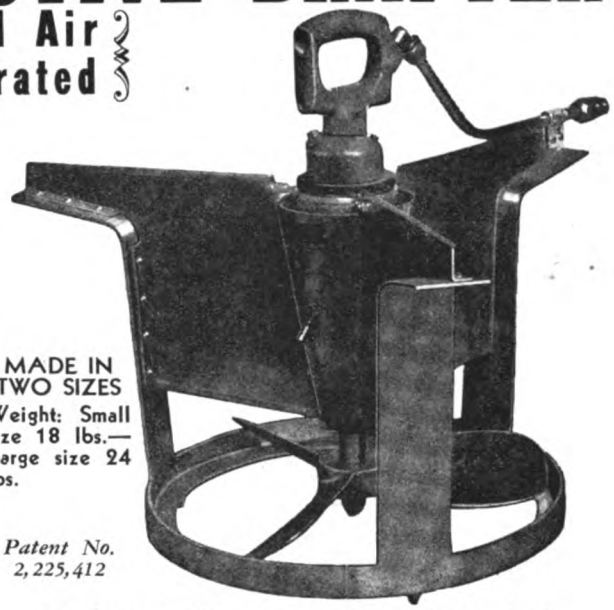
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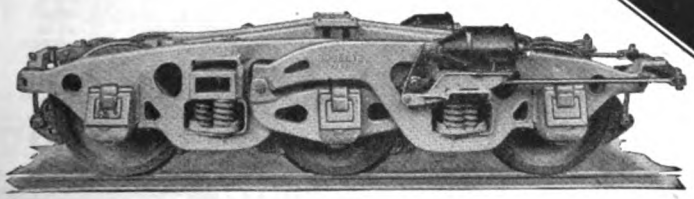
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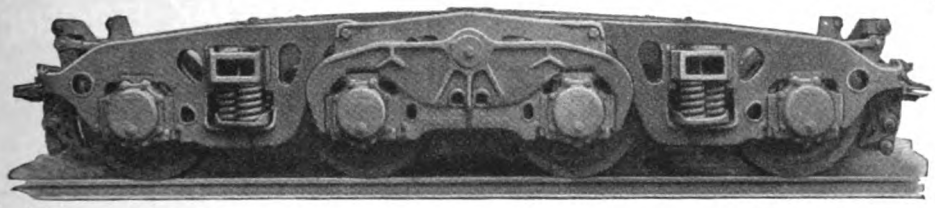
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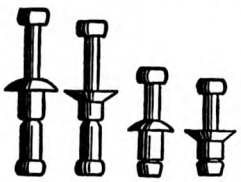


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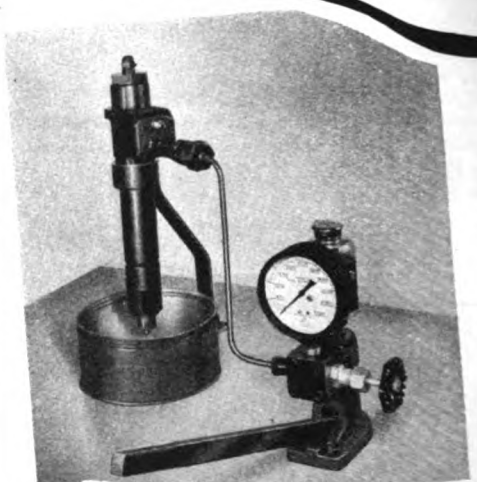
WRITE FOR HANDBOOK. Get the complete story on Cherry Rivets in Handbook A-43. Address Dept. A-277, Cherry Rivet Company, 231 Winston Street, Los Angeles 13, Calif.

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Company
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ADECO

NOZZLE TESTER



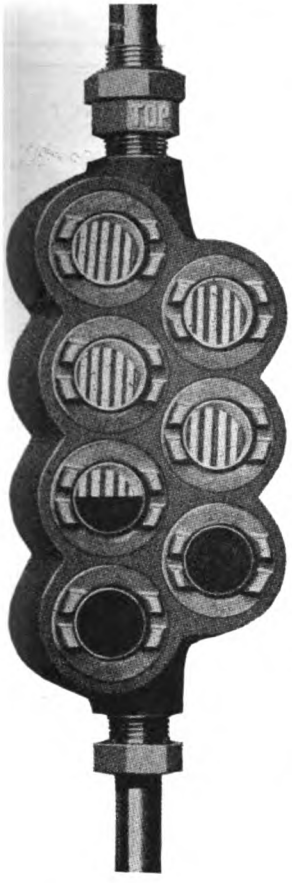
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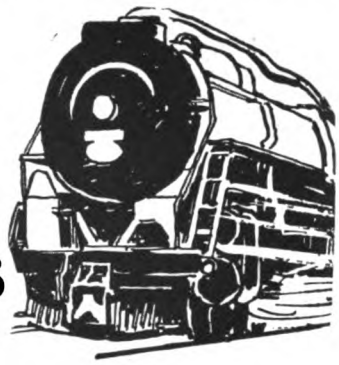
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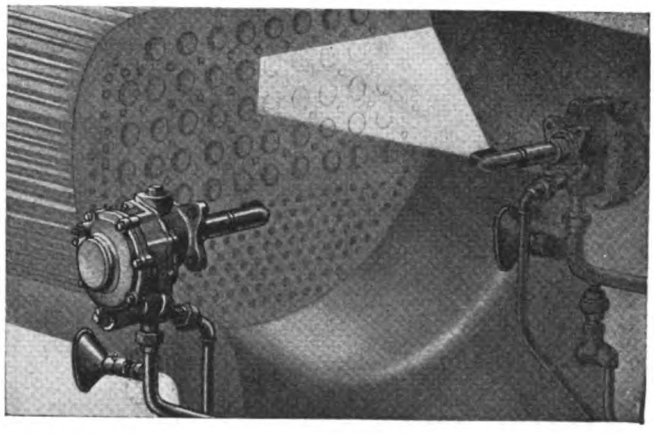
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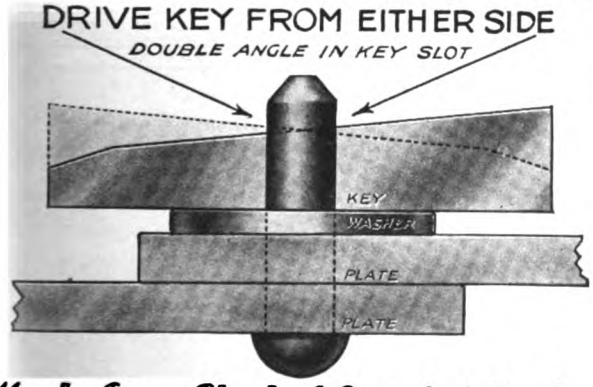
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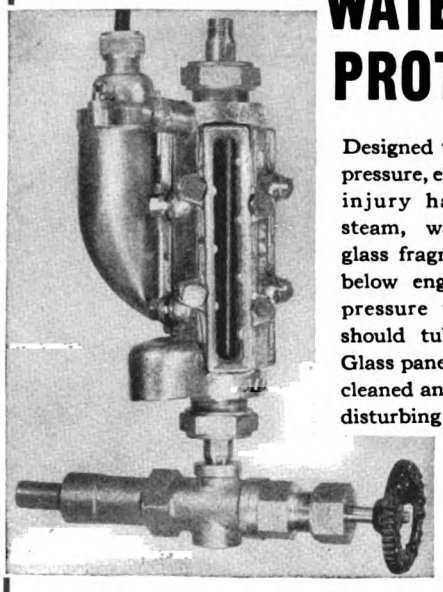
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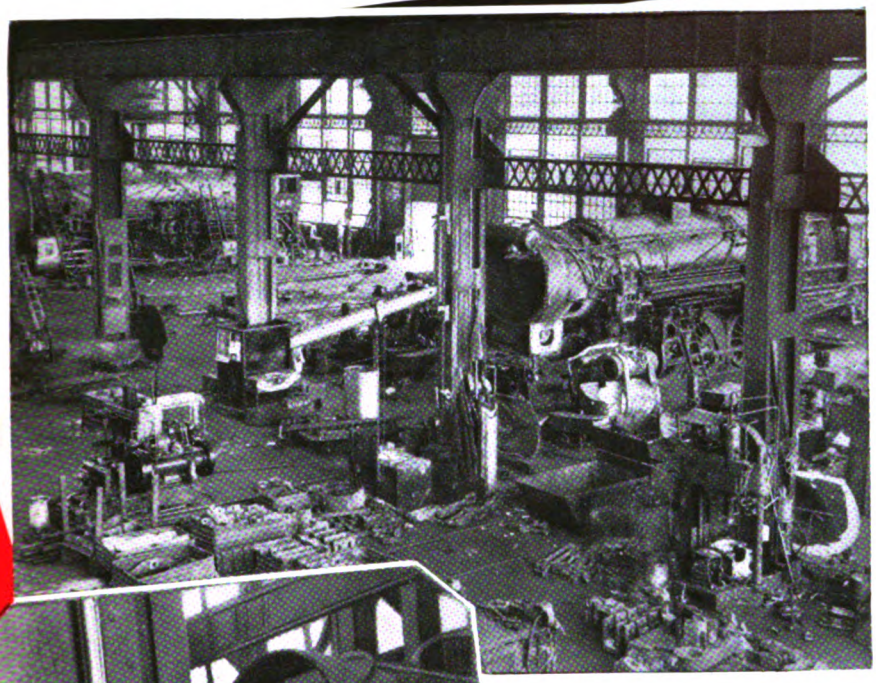
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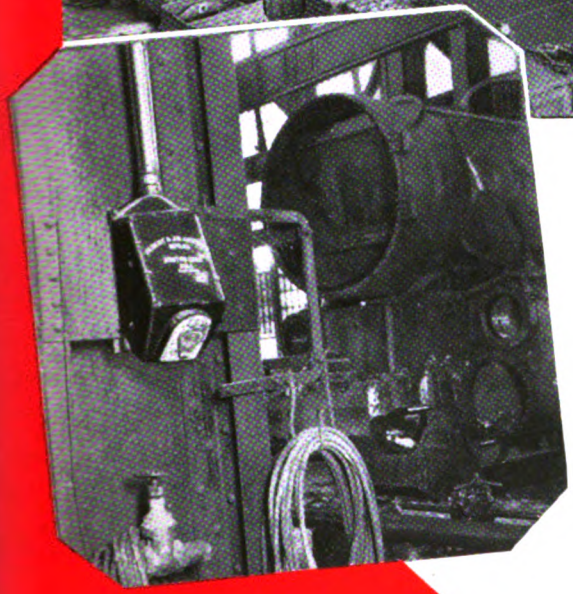
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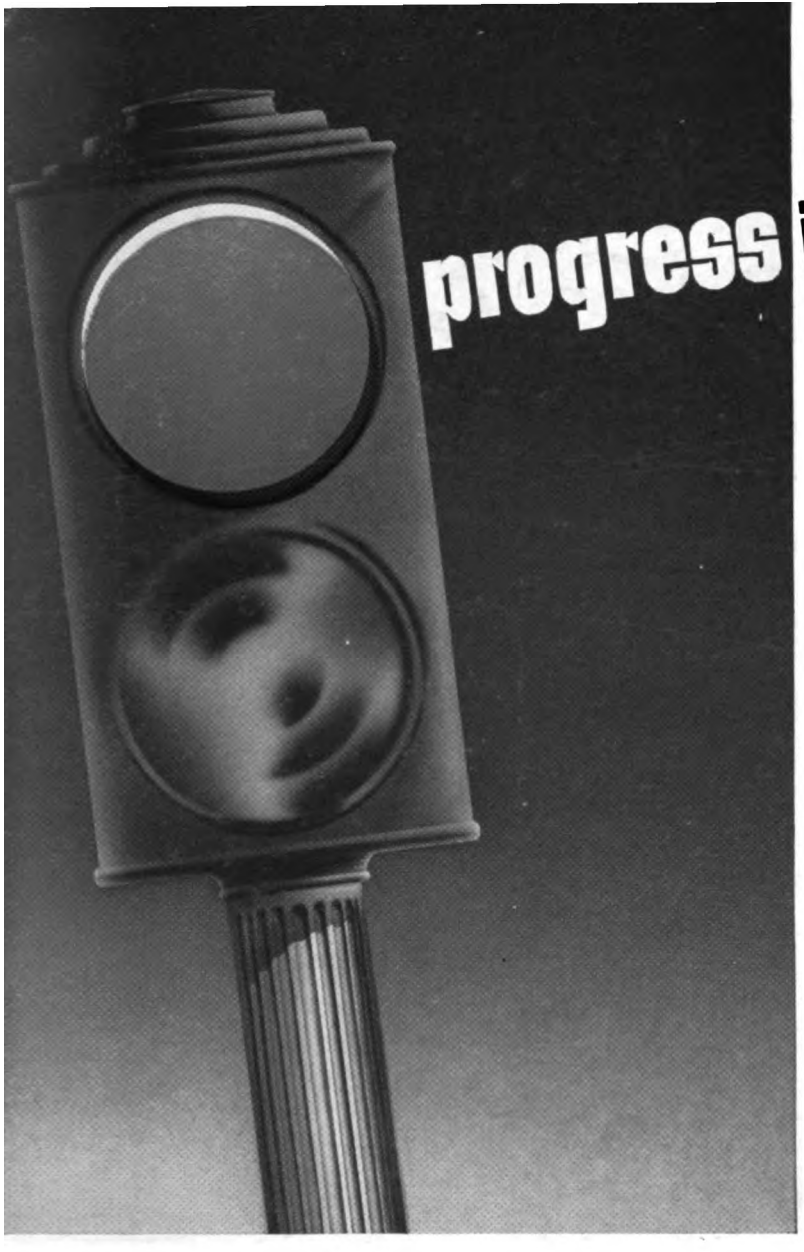


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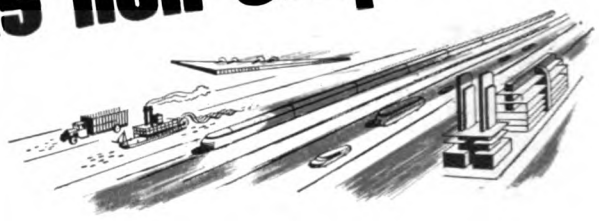
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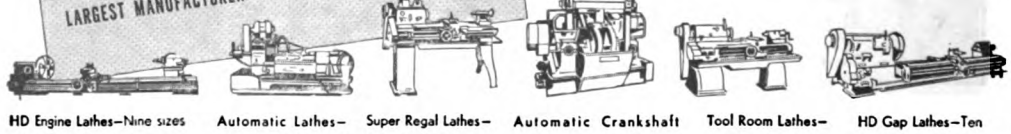
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